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Vol. XIII No. 1 1959 $1.00

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80 pp. *International Conciliation* No. 521

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Volume XIII 1959 No. 1

SCIENCE AND WORLD POLITICS

EDITOR'S FOREWORD 5

WARNER R. SCHILLING — *Science, Technology and Foreign Policy* 7

MARK G. FIELD — *Soviet Science and Some Implications for American Science and Society* 19

SEYMOUR MELMAN — *The Political Implications of Inspection for Disarmament* 34

HUGH ODISHAW — *The International Geophysical Year and World Politics* 47

ROBERT B. VON MEHREN — *The International Atomic Energy Agency in World Politics* 57

ALBERT C. STILLSON — *The Military Control of Outer Space* 70

CHRISTOPHER WRIGHT — *Scientific Progress and the Government of Outer Space* 78

BOOK REVIEWS 93

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Published twice a year by the Board of Editors of the *Journal of International Affairs*. Editorial and Business address: 429 West 117 Street, New York 27, New York. Telephone: UNiversity 5-4000, ext. 2247. Price: $1.00 per copy; three-year subscription for $5.00. Information on subscription and back-copy rates sent upon request.

Printed by Coccè Press, 9 Barrow Street, New York 14, New York

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Journal of International Affairs

EDITOR'S FOREWORD

This issue of the *Journal* presents studies of the impact of recent scientific developments on world politics. That this impact has been great is well illustrated by the fact that the present stage in world politics is referred to as the Atomic Age or the Space Age. Both ages derive their titles from sudden and unprecedented refinements made by man in his scientific thinking.

In terms of war and peace, a twofold and principal impact concerns the fact that while man has discovered scientific techniques of warfare which threaten annihilation, he has also discovered techniques of inspection and control which can serve as insurance against annihilation. Progress in the realm of techniques of warfare has been indeed greater; however, there has recently been considerable progress along the lines of inspection and control.

It is in the realm of scientific techniques of inspection and control that man can presently see his greatest hopes for survival amidst the means of total destruction. If nations could reach political agreements for the implementation of techniques of prevention of surprise attack, disarmament inspection, the government of outer space and the like, a great assurance against annihilation would seem to be realizable. However, the logic of decisions in the field of world politics differs considerably from the logic used in the scientific laboratory.

As man has continued to take giant steps forward in the realm of science, he has continued to take only baby steps in the realm of world politics. The resultant lag is an expression of the perennial gap which has existed between man's thinking and his institutions. But the possible consequences of not filling this gap have never been as great as they are today. It is heartening, as Professor Fox has indicated, that there is also an "endless frontier of politics."

The contributors to this issue have used various approaches to their discussions of some of the countless ramifications of the impact of science on world politics. Professor Schilling explores the historical relationship of science to world politics and considers the variables and constants which occur in that relationship. In addition, the problems and opportunities posed by the present and prospective scientific developments are treated. Professor Field is concerned with the organization of Soviet science and research and the implications of that science for the United States.

Professor Melman, whose recent book is a unique contribution to the literature on inspection for disarmament, summarizes the findings of the studies presented in his book and greatly extends his original remarks concerning the political implications of those findings.

Dr. Odishaw discusses the International Geophysical Year and Mr. von Mehren discusses the International Atomic Energy Agency. Both

institutions represent attempts at scientific cooperation on an international scale and both institutions have been thrust into the field of world politics. In Dr. Odishaw's judgement, the instances of cooperation far outweigh the incidents of non-cooperation and the resulting major achievements of the International Geophysical Year are discussed in this light. Mr. von Mehren shows that the International Atomic Energy Agency is primarily a political institution, and that since agreement on that basis has been limited, the Agency has failed to attain its major objectives.

The final two articles of this issue deal with two speculative aspects of the Space Age. Mr. Stillson is concerned with the problems and prospects of the military control of outer space and has enumerated the objectives for such policy planning by the United States. Mr. Wright is concerned with the government of outer space and he has critically analyzed recent discussions in the United Nations on the subject.

The contributors to this issue are representative of both the natural and social sciences. However, a minimum of technical scientific information is presented. Due to the limitation of space, none of the contributors has been able to develop his particular approach to the subject of this issue as fully as both he and the Board of Editors would have desired. Nonetheless, each article enumerates the major problems of the various approaches in addition to providing references for the reader who wishes to study other literature on the subject.

SCIENCE, TECHNOLOGY, AND FOREIGN POLICY

By Warner R. Schilling

An Assistant Professor in the Department of Public Law and Government at Columbia University, Mr. Schilling is also Research Associate in the Institute of War and Peace Studies and is an Associate Director of the Council for Atomic Age Studies of Columbia.

This paper is meant to stimulate some general ideas about how the development of scientific knowledge and its technical application will influence the future direction of American foreign policy. The first part of the paper will survey the impact that science and technology have had on world politics in the recent past. This is perhaps the best way to alert one's self to the full range over which future change may be expected to occur. The second part will list some of the constant as well as the changing characteristics of this historical relationship. Finally, in the third part, an effort will be made to indicate a few of the foreign policy problems and opportunities posed by present and prospective scientific and technological developments.

I

The dominant technological development of the past 300 years has been the large-scale and increasing substitution of inanimate for animate energy as the motive force for man's machines. This substitution had its early beginnings in the use of wind and water, but it was only with the discovery of how to convert the heat from the burning of fossil fuels into mechanical energy and how to convert mechanical into electrical energy and back again that inanimate energy became both plentiful and transportable. It is this energy base that has made possible that whole complex of technological, economic and social developments that we associate with modern industrial civilization.[2]

Clearly, none of the key elements in the international political

[1] Recent conversations with William T. R. Fox stimulated much of the content of this paper and the arresting phrase "the endless frontier of politics" should in particular be acknowledged.

[2] For an effort to put history in an energy perspective, see Max Born, "Europe and Science," *Bulletin of the Atomic Scientists*, February 1958. Hereafter cited as BAS.

process has been untouched by the industrial revolution. The structure of the state system and of states themselves, the purposes and expectations moving state policy, and the means available to states for securing their purposes have all been significantly altered.

Consider the changes in the structure of the state system, that is, in the number and relative power of its members. As the industrial revolution transformed the bases for military power, the hegemony of the industrial states over the non-industrial areas of the world became virtually complete. Indeed, the Europeans had already been able to impress their rule over the better part of the globe with such rudimentary energy advantages as the sail and gunpowder, and, until the industrialization of Japan and the United States, world politics was essentially European politics.

The structure of the European state system was no less affected by the new technology. The enhanced opportunities for union, voluntary or involuntary, saw the number of states in Europe reduced from 400 at the time of the peace of Westphalia to less than 100 by 1815 and a mere 30 in 1878.[3] The disparity in power between large and small states was greatly increased (contrast the vulnerability of the Lowlands in 1914 and 1940 with their military exploits against Spain in the late 16th century), and drastic changes occurred in the distribution of power among the Great Powers themselves, most notably by the early industrialization of England and the later displacement of France by Germany as the dominant power on the Continent.

These changes in the number, relative power, and location of the states making up the system have had great consequence for both the stability of the system itself and the character of the strategies pursued by individual states within it. Two world wars testify to the instabilities introduced by the rise of German power. Similarly, the whole character of American foreign policy has been altered as the United States moved, from a position where its sheer survival was dependent upon the commitment of European power and interest elsewhere than the North American continent, to a position where its military potential exceeded that of all the European powers combined.

Equally striking have been the changes in the political structures of states themselves. The development of the urban industrial nation has made possible the rise of a variety of new elites and new political relationships between elites and masses. The impact of these new modes of government on foreign policy is to be understood by virtue of the fact that the manner in which foreign policy decisions are made can

[3] See Quincy Wright, "Modern Technology and the World Order," in W. F. Ogburn (ed.), *Technology and International Relations* (Chicago: The University of Chicago Press, 1949), p. 181, for this point and a rewarding general treatment of the subject.

affect the content of policy itself. Thus, for those states in which technical advances in transportation and communications have been followed by a wider diffusion of political power, the possibilities for unstable or inconsistent policies (or indeed no policy at all) have been significantly increased.

The impact of changing technology on the purposes of state policy has perhaps been most marked on what might be considered the "intermediate" level of the ends-means chain. Thus, while states may have been continuous in their pursuit of such general goals as "power" and "welfare," there has been considerable variation in the operational definition of these goals. Consider, for example, the changing evaluation that states have assigned to particular areas of real estate on the globe. The success of the American Revolution owes much to France's decision that her power relative to England's would be better increased by depriving England of her North American colonies than by taking the opportunity that was also present to accomplish her traditional aim of conquering the Lowlands. Similarly, the present focus of interest on the Middle East is not unrelated to the increased dependence of Western Europe on that area's oil reserves. Among many of the so-called underdeveloped states in the world today, the effort to secure an industrial technology has itself become one of the major preoccupations of foreign policy. As for the contribution of technology to changes in the more "ultimate" purposes of state policy, it must be noted that just as technological change makes possible all sorts of new arrangements of things and people, it also gives people an opportunity to differ as to how these new arrangements are to be made. Thus, the present conflict between the Soviet Union and the United States owes much to the fact that they have evolved differing conceptions of the proper arrangement of things and people in an industrial society and that they seem persuaded that their conception of the good life must and should prevail elsewhere.

The relation of science to foreign policy is for the most part indirect, since society usually experiences new additions to scientific knowledge in the form of the technical applications of that knowledge. This is not the case, however, with respect to man's general expectations about the course of human events. Here, new knowledge about man and the universe in which he lives can lead directly to a reorientation of such expectations. The belief of 17th and 18th century statesmen in the balance of power as the natural order of state relations was in part a reflection of their appreciation for the picture of measured order and equilibrium that science then presented of the physical world. Similarly, international politics by the turn of the 19th century was conditioned by a whole host of expectations concerning the "natural" struggle of states and the "inevitability" of selection against the

weaker that had been stimulated by Darwin's concepts concerning the evolutionary process.[4]

The major alternatives available to states for securing their purposes (persuasion, bargaining and coercion) remain the same, but the techniques through which states may employ these means have been greatly altered by recent technology. The history of Anglo-American relations turned on two occasions upon the slowness of trans-Atlantic communication in the day of sail, in 1778 when British concessions "raced" against the French offer of an alliance, and again in 1812 when news of the impending British repeal of the orders-in-council arrived only after the Congressional vote for war.[5] Today the words of governments can be spread almost instantaneously around the world, and their agents are only hours away from the most distant foreign capitals. There have been accompanying changes in both the content of international communications and the personnel of the communicators and the audience, and there are those who maintain that negotiation has become all but impossible when undertaken by quickly assembled major figures before the attentive publics of the world.

What technology has given with one hand, by increasing the speed of communication, it has taken with the other by decreasing the time available for decision. Not even the telegraph was able to offset the pressures placed upon diplomats in 1914 by the mobilization tables of the general staffs, whose own time bind was the result of the contribution that the railroad had made to the speed with which large armies could be assembled on enemy frontiers.

Since, in Nicholas Spykman's classic phrase, "international relations are conducted to the constant accompaniment of the drums of battle," the relationship between technology and foreign policy is nowhere more evident than in the innovations made in the instruments for coercion.[6] In fact, the changes here have been broadly reflected in all of the elements previously discussed. Note has already been taken of the changes in the structure of the state system that resulted from the near synonymity of great military power and great industrial power. The development of governmental structures capable of controlling every sphere of human activity and the conduct of diplomacy for its impact on domestic, as well as foreign, audiences likewise reflect the increased military importance of the civilian labor force. And nowhere has the reciprocal relation between ends and means

[4] Point and illustrations from Llewllyn Woodward, "Science and the Relations Between States," BAS, April 1956.

[5] Samuel Flagg Bemis, *A Diplomatic History of the United States* (New York: Appleton-Century-Crofts, Inc., 1949, rev. ed.), pp. 31, 157-158.

[6] Nicholas J. Spykman, *America's Strategy in World Politics* (New York: Harcourt, Brace and Co., 1942), p. 25.

been better demonstrated than by the advent of 20th century total war. As technology increased the number and destructive scope of the weapons of war, thereby increasing the costs in blood and treasure entailed in their production and use, compensation was sought through enlarging the purposes of war, which, in turn, served to stimulate the belligerents to still greater destructive efforts. Understandably enough, the last two wars have also left their mark on some of the general expectations of mankind, most notably that prevalent in the late 19th century concerning the inevitable progress of Western civilization.

II

The preceding discussion has endeavored to show that no element in the international political progress (actors, ends, expectations, means, or field) has been untouched by the technological developments of the past two centuries.[7] Attention may now be directed to some of the general characteristics of this relationship. Seven in all will be considered, the first three of which have been constant over time and seem likely to remain so, whereas the last four appear to be trend developments.

(1) The technical developments involved in political change are usually multi-rather than mono-factor. Thus, in seeking an explanation for the British decision in 1912 to cancel plans for a close blockade of Germany, attention must be directed to a multiplicity of developments (torpedoes, mines, submarines, steam engines) rather than to any single technical innovation.[8]

(2) Major changes in the character of international relations have been the result of a multiplicity of non-technical factors as well as technical. The end of the limited warfare of the 18th century can only be partially explained by such important technical changes as better roads, increased metal production, or the increased efficiency of firearms and artillery. Reference must also be made to critical changes in political goals (the displacement of territorial and commercial objectives by the ideological issues of the American and French Revolutions); changes in military doctrine (organizational innovations making more easy the direction of large armies, and the development of more aggressive and sustained campaign tactics, which were in turn made possible by changes in the number and social character of troops as a result of the changes in political goals); and even changes in the general cultural ethos (lessened belief in the sinful character of man

[7] These ordering concepts are a modified version of those advanced by Gabriel Almond some years ago.

[8] See Bernard Brodie, *Sea Power in the Machine Age* (Princeton: Princeton University Press, 1941), pp. 18-19, 76-77.

with a consequent loosening of the inhibitions against weapons development, and a shift from an interest in making products of artistic beauty to a concern for low-cost and quantity production).[9]

(3) The political advantages of technological change have been unequally distributed among states, both temporarily and permanently. Economic development in Asia and elsewhere is greatly complicated by the fact that its industrialization (unlike Europe's) must follow the spectacular decline in death rates made possible by medical science. Another example is afforded by the American experience with nuclear weapons. The advantages of short-lived monopoly have been followed by a revolutionary decline in the American security position. Unlike Germany, the Soviet Union has no need to conquer the Old World before it can command the resources necessary to strike a mortal blow at the United States. The destructiveness, range and cheapness of nuclear weapons systems have stripped America of her cushions of allies, time and space and have canceled out the industrial superiority that meant defeat for her enemies in the last two world wars.

(4) In the early years of the industrial revolution technology developed independently of advances in basic scientific knowledge. Steam engines were built long before the basic scientific laws governing their behavior were formulated. However, since the turn of the last century, the development of technology has been increasingly dependent upon advances in basic knowledge about the physical world. The atomic bomb was not only contingent upon basic research in nuclear physics; many of the technical applications of this new knowledge were actually carried through by the theoretical physicists themselves.

(5) Both technological innovation and the growth of new scientific knowledge appear to be increasing at an exponential rate. Scientific knowledge (as crudely measured by the volume of scientific publication) is apparently doubling every ten to fifteen years. In the first 300 years after the invention of firearms, the improvement of the original crude product was so slow that Benjamin Franklin apparently seriously considered arming the Continental Army with bows and arrows.[10] In contrast, only 90 years passed between the first successful steamship and the disappearance of sails from warships, and a bare 55 years will separate the flight of Orville Wright from the first rocket to the moon.

[9] See John U. Nef, *War and Human Progress* (Cambridge: Harvard University Press, 1952), chs. 9-11, 14, 16.

[10] Publication point from Ellis A. Johnson, "The Crisis in Science and Technology and its Effect on Military Development," *Operations Research*, January-February 1958, pp. 14-15. Franklin reference from Brodie, "Implications of Nuclear Weapons in Total War," RAND Memorandum 1842, p. 2.

(6) Both the costs of acquiring new scientific knowledge and the costs of product innovation appear to be increasing, at least in a number of key areas. One reason why university research budgets have become so dependent on federal funds is that no other source is rich enough to meet the costs of new research. The situation in some fields of nuclear physics was well expressed by the scientist who observed that "it costs a million dollars even to ask the question." Similarly, a fighter plane could be produced for 17,000 engineering hours in 1940, but 1,400,000 hours were required by 1955.[11] The point to these trends would seem to be that not only Great Powers alone can have great technology but that in the future only Great Powers will have great science.[12]

(7) In World War II science was for the first time directly mobilized in support of foreign policy. Science in its purest form (the discovery of the facts of nature for knowledge's sake alone) had developed since the 17th century into an essentially autonomous social institution. The scientific community had certain canons with regard to the conditions of their work. Science was international (the facts of nature were open to all who chose to discover them through the methods of science) and the advancement of knowledge was dependent on freedom of research, i.e., freedom of choice with respect to the research problem and freedom to communicate the results of research. But except for the general assumption that new knowledge would ultimately benefit mankind, the scientific community largely disassociated itself from whatever practical applications that might come from their discoveries.[13]

During the great ideological wars of the early 19th century, scientists and their ideas were allowed to pass freely across political frontiers, both in time of peace and war. This practice is more understandable when it is realized that as late as 1900 states also permitted the free circulation of detailed plans of their major weapons and most recent weapon innovations.[14] During World War I states made some primitive efforts to apply scientists to the problems of war, but it was

[11] Victor Weisskopf, as quoted in Theodore H. White, "U.S. Science: The Troubled Quest," *The Reporter,* September 23, 1954, p. 14. Engineering figures from Johnson, *op. cit.,* p. 16.

[12] Note, however, that by a pooling of their scientific effort the states, for example, of Western Europe could achieve "great science" without necessarily achieving any of the other attributes of "Great Powerhood."

[13] See Margret Smith Stahl, "Splits and Schisms: Nuclear and Social," Unpublished Doctoral Dissertation, University of Wisconsin, 1946, ch. 4.

[14] On the early political experience of scientists, see Sir Henry Dale, "Freedom of Science," BAS, May 1949; on 19th century military disclosures, Brodie, "Military Demonstrations and Disclosures of New Weapons," *World Politics,* April, 1953, pp. 283-288.

only with the advent of World War II that the resources of the scientific community were brought to bear on such problems in any extensive fashion. The results of this effort (radar, the proximity fuse, the A-bomb) were such as to guarantee that its value would not be forgetten with the war's end.

III

Turning now to a brief list of foreign policy problems and opportunities, the last four developments discussed above clearly give first priority to the relationship between government and science. Had the victorious coalition against Germany not so emphatically followed the historical pattern, perhaps science could have regained some semblance of its pre-war autonomy. As it was, by 1955 about 50 per cent of the nation's engineers and 25 per cent of its scientists were in the employment of the government, either directly or on contract; in universities some 70 per cent of the research budget was government financed; and scientists were invited into the highest councils of government.[15] This activity simply reflects the fact that as the two Super Powers throw one weapons system after another into the effort to maintain at least a balance of terror, neither deems it prudent to fall behind in either the discovery of new scientific principles or the application of scientific knowledge to military hardware and political-military strategy.

In the present and the future world, "the science potential of nations" must take its place alongside such traditional items as the production of steel or electric energy as a meaningful index of military potential. In 1945 and 1946 the wartime experience of scientists stimulated considerable discussion of the question of whether the government could or should influence the direction of scientific development. This is now a dead issue; the government does and must. To be sure, neither the generation of brand new ideas or the derivation of gadgets from extant ideas follows directly in proportion to the number of scientists at work or the amount of equipment at their disposal. But the supply of scientific talent is rather limited (the debate in 1949 over whether and how to undertake a "crash program" to make an H-bomb was operationally concerned with the allocation of no more than thirty and perhaps as few as five individuals) and allocation of this talent's time (and therefore to a considerable extent the character of its product) is obviously influenced by the extent and direction of the government's appeals and support.

The question of whether our science potential is being developed

[15] Lee A. DuBridge, "The American Scientist: 1955," *Yale Review*, Spring 1955, p. 13, and American Association for the Advancement of Science, "Interim Committee Report," BAS, March 1957, p. 82.

in the most desirable or efficacious manner will be a continuing issue. Here the concepts developed for the analysis of war potential may prove quite useful.[16] Applying Klaus Knorr's major categories — resources, motivation and administrative skill—to the current scene, it is clear that the United States is quite favorably situated vis-à-vis the Soviet Union with respect to the basic resource, students. Thus, in 1954, despite the fact that only one out of five high school graduates ended up as a college graduate, the United States still had more than twice as many college graduates as the Soviet Union. While there is some cause to believe that the "state of the arts" was better in the Soviet Union, i.e., that their students received the better education, the main point is that about 50 per cent of the Soviet students majored in science and engineering, in contrast to about 15 per cent in the United States. Accordingly, our output of scientists and engineers was only 70 per cent of that of the Soviet Union.[17]

If one could be sure that we "want" more scientists and engineers than we graduate, some examination of our administrative skills would be in order. However, the major explanation for the continued greater Soviet output would seem in any case to be a matter of motivation. The complex that makes up the American "we" in this instance has simply placed a much lower value on the production of such graduates. One way in which foreign policy can serve to compensate for America's lesser motivation is by expanding the resource base to include the NATO countries. The addition of the scientists and engineers graduated in these states would produce a total nearly equal to the Soviet output. Truly effective scientific coordination with the NATO states would require at least a partial restoration of the "international community" of science that existed before World War II, and this would entail some loss in our ability to impose and maintain secrecy. But in return we would gain in knowledge, and the progress of Soviet science is such that most of our "secrets" are really not secret anyway.[18]

The variable of administrative skills is most evident in the distribution of the Russian and American effort between applied research and basic research, the discovery of new knowledge. The Soviet Union has between 20 to 30 per cent more scientists engaged in basic research than the United States. The percentage allocated to basic research in

[16] See Klaus Knorr, *The War Potential of Nations* (Princeton: Princeton University Press, 1956).

[17] Joint Committee on Atomic Energy, 84th Congress, 2nd Session, Committee Print, *Engineering and Scientific Manpower in the United States, Western Europe and Soviet Russia,* (Washington, 1956), pp. 66, 78, 81.

[18] For some specific proposals in this connection, see the account given of a report prepared in October 1957 for Senator Henry M. Jackson in *The New York Times,* October 23, 1957. For the issue of secrecy, see Edward Teller, "Alternatives for Security," *Foreign Affairs,* January 1958, pp. 207-208.

the budgets of Russian scientific academies has been estimated at 20 to 30, which is, interestingly enough, approximately the same percentage that the Russians allocate of their gross national product to gross investment. The American emphasis on applied research would pay military dividends if a war comes soon (or if this is the only way we can maintain the balance of terror), but otherwise we shall be left to face the costs of a narrower knowledge base in the future. Superior administrative skills would also seem evident in the estimate that the Russians develop new weapons systems in about half the time it takes the United States.[19]

The end result of greater motivation and superior administrative skill can be read in Edward Teller's predication that in ten years scientific leadership will pass into the hands of the Soviet Union. Reconsidered "wants" and administrative changes can not now prevent this from happening, although they can affect an American endeavor to regain that leadership.[20] The Soviets appear to have duplicated in science what Germany did before World War II in military power (mobilizing a superior force from an inferior resource base) while at the same time avoiding Germany's failure to expand their productive capacity. The political consequences of Soviet leadership will not be restricted to the fact that the Russians will have a larger knowledge base from which to develop new weapons. Just as a reputation for military power yields political results above and beyond the actual forces on hand, so too may the Soviet Union be expected to reap political benefit from its "scientific prestige," especially among the undeveloped states where scientific and technological achievements stand as symbols of the good life they hope to achieve.

The discussion of the "production" of scientific knowledge should not conclude without observing that it would be unrealistic to expect scientists to be as responsive to the demands of national policy as is the output of Hoover Dam and it would be extremely shortsighted to wish that they were. The character of modern weapons is such that additions to or innovations in our military capabilities mainly serve to keep our security from deteriorating. Unless we should decide to rem-

[19] Figure on scientists from the report of the National Science Foundation, October 16, 1957, as summarized in BAS, December 1957. Figure on budgets provided by Professor M. D. Hassialis, Columbia University, and based on discussions with Russian scientists. Figure on development time from Johnson, *op. cit.*, p. 16.

At his press conference on October 30, 1957, President Eisenhower said he had been "astonished" to learn that the major concern of his Scientific Advisory Council was where American science would be in ten years and whether the government would take the initiative in securing more funds and effort for basic research. See text, *The New York Times,* October 31, 1957.

[20] Testimony of Edward Teller, Preparedness Subcommittee of Senate Committee on Armed Services, 85th Congress, 1st and 2nd Sessions, Hearings, *Inquiry Into Satellites and Missile Programs,* (Washington, 1958), Part I, pp. 42-43.

edy our long-standing deficiencies for limited war, they promise little in the way of enhanced security. If we are to produce real improvements in security, it must be in the realm of the political perspectives of our enemies, their goals and expectations. In the furtherance of such an intent-oriented (as compared to capability-oriented) security policy, the image we present of ourselves to the outside world is most critical. The scientific tradition (its freedoms and its dedication to liberating the "human mind from ignorance and consequent fear"),[21] is both an attractive and long cherished part of our "self." It, too, can bring "security," and we should not forget it.

Should the greater number of Soviet scientists result in their having a significant edge in the qualitative and quantitative production of knowledge, it by no means follows that hideous ruin and combustion will overtake our foreign policy. What is certain is that the science of all nations will continue to stimulate new technological and political developments. The structure of the state system is still in a state of flux from the advent of nuclear power; its impact has yet to be made in Western Europe, much less in the great continental areas of India and China. Nor have secrecy, security risks and the increased influence of scientific and military elites (and hence the influence of their policy perspectives) exhausted the changes that the prospect of thermonuclear ruin will bring to internal state structures. And we may confidently expect the intermediate goals of American foreign policy to be quite different now that we have moved from an era where the enemy's conquest of Europe was the *sine qua non* for even a fifty-fifty chance to invade us, to an era where such conquest will only make somewhat more cheap the cost of his "America-bomb."

Nuclear technology has compelled the Russians to revise their expectations about inevitable war, but man's expectations have yet to react fully to relativity theory or anti-matter, not to mention machines that are capable of creative thought. Nuclear weapons systems promise a whole host of new political issues, of which test fall-out and the probability of satellite "downings" may be only a harbinger. The character of these systems can also be expected to lead to considerable proliferation among the non-violent techniques for pursuing and resolving interest conflicts, including more than a few more words about surrender.

Certainly the contribution that we can make to the economic development of India and less important states can capitalize on the potentiality of medical science to develop more effective techniques for birth control. Similarly, the fact that automation can now be substituted for the deficiencies in the human nervous system, just as inanimate power was substituted for the deficiencies of the human

[21] Quotation from DuBridge, *op. cit.*, p. 4.

muscle, requires us to re-examine our theories regarding the economic prospects and problems of these countries.[22] In short, there is clearly room in our foreign policy for "scientific aid" programs, although we may here find the Soviet scientists as worrisome as we have found their "surplus" engineers and conventional weapons.

The list of possibilities and problems could be multiplied were we to venture further into the scientific future and consider such prospects as weather control, psycho-chemistry, controlled thermonuclear power, or the variety of communications which can be made from satellites. But it must be remembered that man has never been the passive tool of his technology. When the idea of the A-bomb came to Washington in 1939 it found the concept of strategic bombing waiting for it, and, as such classic instances as the divergent development of French and German military doctrine before 1940 amply demonstrate, it can make considerable difference which ideas man brings to his technology.[23]

Important as the scientific discoveries and technical innovations of the past century have been, so too have been man's social and political discoveries and innovations. The history of these years must also be written with reference, for example, to the Protestant ethic, nationalism, bureaucracy, the balance of power, collective security and Marxist-Leninist doctrine, not to mention the content of the social sciences. In brief, there is an "endless frontier" to politics, as well as science, and man's fate will be determined as much by his "adventures" along the one as the other.

[22] For this conception of automation, see Gerald Piel, "Science and the Next Fifty Years," BAS, January, 1954. Some economic possibilities are outlined in Richard L. Meier, "Automatic Technology and Economic Development", BAS, April, 1954.

[23] For a very stimulating discussion of the contribution that political science can make in this connection, see Harold Lasswell, "The Political Science of Science," *American Political Science Review*, December, 1956.

SOVIET SCIENCE AND SOME IMPLICATIONS FOR AMERICAN SCIENCE AND SOCIETY[1]

By Mark G. Field

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Americans who have visited the Soviet Union have rarely failed to be impressed and surprised by the relatively high social prestige and particularly by the luxurious standard of living of scientists when compared either to the rest of the Soviet population, or to scientists and academicians in the United States. This surprise actually may stem from a basic misconception of Soviet reality, fostered by Soviet policies in the twenties that Soviet society was a classless equalitarian system rather than one that became elaborately stratified in the thirties and has remained so to this day.[2] These visitors are also likely, in moments of post-sputnik bitterness, to compare the position of American scientists to business managers, advertising executives, truck drivers or professional wrestlers. From this some have concluded (correctly enough) that science and intellectual pursuits in general occupy a favored position in the Soviet scheme of things and (not quite correctly, perhaps) that scientific work and productivity in the USSR are stimulated primarily by the high rewards, material and honorific, that the regime places at the disposal of

[1] I gratefully acknowledge the insights and the information given me by my colleagues, Karl Hill and Thomas Butler, in the writing of this paper. I alone, however, bear responsibility for the text and the conclusions.

[2] For a highly authoritative description of stratification in the USSR see Alex Inkeles, "Stratification and Mobility in the Soviet Union: 1940-1950," *American Sociological Review*, XV: 465-479. (August, 1950). It is also interesting to note that even honorific rewards for scientists are ranked according to position held in the scientific hierarchy. Thus it may be possible for a member (either active or corresponding) of the Academy of Sciences to earn the "Order to the Emblem of Honor" in only 10 years of irreproachable work; for personnel who are not academicians this will take 15 years; and for junior personnel, 20 years. *Vedemosti Verkhovnogo Soveta*, No. 61, November 27, 1949.

science.[3] The second conclusion, derived from Pavlovian conditioned reflex theory and Watsonian concepts of behaviorism, simply assumes a sort of "push-pull" mechanism, so dear to a consumption economy, in which the more food being offered to a starved rat, the faster he runs in the maze and the more fruitful the results of his cogitative sprints. The logical implications for American society are crystal clear: by increasing the monetary rewards held out to scientists and professors and by honoring them with brightly colored ribbons, the bright young men who now succumb to the lure of such financially rewarding occupations as selling cars or peddling stocks and bonds would stream into the laboratories of the nation and, once there, place bigger and better sputniks into orbit. Such reasoning, however, fails to delve deeply enough into what we might call the "atmosphere of science," the motivation for going into scientific work and for remaining in this field. It assumes that high income *per se* constitutes a universal appeal for all occupations and pursuits, and enough stimulation for scientific and intellectual creativity. It fails, as such, to examine other types of "rewards" such as the inner and self-sustaining satisfaction derived from research and discovery, as well as the social mechanisms whereby individuals become sensitized to these inner rewards. We shall return, at the appropriate moment, to this very thorny and vital question of motivation for, and recruitment into, scientific work and pursuits. We must first, however, set the discussion both in its proper social perspective and in the framework of the international situation.

I

In many respects the world of today is a *system* to a degree it never was before in history. The nations of the world, by virtue of modern communications and contemporary weapons, are so meaningfully related to each other that whatever happens in one is never completely irrelevant to the others. One might conjecture that the impact on the Soviet leadership of the explosion by the United States of an atomic device over Japan in 1945 was overwhelming. Here was a development that established an awesome superiority for the West and imperiled the post-war balance of power between the United States and the Soviet Union.

This explosion could not but lead to a series of decisions placing top priority on the re-establishment of pre-Hiroshima parity

[3] "The salary scale of professors is probably the key to the very advanced state of academic life in Russia. The income of a university science professor varies between $30,000 and $60,000 per year . . . it may reach $100,000 in some instances [based on an inflated value of the rouble] . . . With his servants, assistants, car and chauffeur and large income, he can devote himself completely to fundamental work . . ." J. O'M. Bockris, "A Scientist's Impressions of Russian Research," *The Reporter*, February 20, 1958, p. 16.

through the development, at high speed, of equivalent or more powerful atomic devices. Orders from the Kremlin flowed, priorities were established, scarce material resources were made available, personnel were alerted, mobilized, shifted around, laboratories built and spy rings galvanized. And by the same token, the launching of Sputnik I jarred American society, indicating once more how meaningfully inter-related the contemporary world system is and how science and the scientists, at this juncture in history, have become the focal point of strategy and national concern. It may, therefore, be instructive to go back into history and to follow the development and mobilization of Soviet science to serve the needs of the Soviet state under the impact of the world situation. This development can be traced to the end of the twenties when the Soviet leaders, convinced that no other proletarian revolutions were forthcoming in the near future, decided to proceed with the industrialization of Russia at an accelerated pace. If until then the slogan was that the workers of the world had no fatherland, they now had one: the Soviet Union. The first socialist state in the world was to become the center of the world proletariat and of the world revolutionary movement, and in order to make this center strong it had to industrialize at all costs and very rapidly. In a strangely prophetic speech, Stalin declared, in 1931:

> It is sometimes asked whether it is not possible to slow down the tempo a bit, to put a check on the movement. No, comrades, it is not possible . . . This is dictated to us by our obligations to the working class of the whole world. To slacken the tempo would mean falling behind . . . One feature of the history of old Russia was the continual beatings she suffered from falling behind . . . She was beaten by the Mongol Khans. She was beaten by the Turkish beys. She was beaten by the Swedish feudal lords. She was beaten by the Polish and Lithuanian gentry. She was beaten by the British and French capitalists. She was beaten by the Japanese barons. All beat her for her backwardness . . . We are fifty or a hundred years behind the advanced countries. We must make good this distance in ten years. Either we do it, or they crush us.[4]

The commitment to industrialization, through a "mobilization" of the entire society also meant a mobilization of science and scientific workers to help solve the manifold problems that the building of a large industrial establishment was bound to bring. Thus, the Academy of Sciences USSR (and we shall return to it in a moment) which had been more or less left alone in the first decade of the regime, was suddenly ordered to leave its ivory tower of pure or theoretical

[4] "The Tasks of Business Executives," in *Problems of Leninism*, 11th ed. (Moscow: Foreign Language Publishing House, 1940), pp. 365-366.

research and to plunge into the "building of socialism."[5] Resistance to this program led to the liquidation of several scientists (about 10 per cent of the membership of the Academy), the exile of others, and the admission into the Academy of "practical" men from production as well as Communist Party members.[6] The mobilization of science was not a new phenomenon in Russian history. Indeed, the very foundation of the St. Petersburg Academy of Sciences in 1724 (the precursor of the present Academy) was suggested by Peter the Great as a means to develop and accelerate the modernization and westernization of Russia. Russian science developed, in the 18th and 19th centuries in a manner not too different from European science in general, though it had certain characteristics that distinguished it both from European and Soviet science.[7] One was that the impetus, the framework and the general support of science and scientific work originally came from the state and the needs of the state, but intellectual activity and scientific work were not subject to ideological dictates as they were to be in the Soviet period. As DeWitt points out, the attitude of the state was one of indifference or, at times, of suspicious hostility.

Equally important was the fact that in contrast with many periods under the Soviet regime, Russian science considered itself truly part of world science; originally many West European scientists had come to Russia to staff the universities and research institutions; and in the 19th and early 20th centuries most Russian scientists went abroad to pursue their studies in Western European laboratories. Furthermore, Russian science was highly abstract and theoretical, (Russians are still considered outstanding mathematicians) lacking the harmonious blend of theory and application which appears to be an important element in the development of scientific knowledge and methodology. The situation, particularly in the second half of the 19th century, by contrast with Western Europe, was such that there was hardly anything to which the theoretical findings of the natural sciences could be applied, since industry was barely beginning to develop. Indeed, at the time the Bolshevik revolution occurred, less

[5] Alexander Vucinich, *The Soviet Academy of Sciences* (Stanford: Stanford University Press, 1956), p. 9 ff.

[6] Including Party theoretician N. I. Bukharin who was to be purged in the late thirties. It may be noted that Party academicians suffered most during these purges, whereas non-Party academicians were pretty much left alone. It is estimated that about one-half of the Academy Party members were either put to death or sent to concentration camps. *ibid.*, p. 9.

[7] These remarks are partly based on Nicholas DeWitt, "Scholarship in the Natural Sciences," a paper presented at the *Arden House Conference on the Transformation of Russian Society since 1861*, April 25-27, 1958.

than one-fifth of the total population was urban[8] and the proletariat was a very small minority still tied in many respects to the countryside from which it had recently come. Even during the industrializing period, between the end of the 19th century and the Revolution, the linkage of pure or theoretical science with industry and technology was at best tenuous. To a considerable degree, the situation remained the same during the first ten years of the Soviet regime, when the Bolsheviks sought to consolidate their power and to restore the national economy to its 1913 level. It is only at the end of the twenties that the *real* revolution in Soviet Russia began; this meant, as we saw earlier, the mobilization of the Academy of Sciences and science in general to help in the task of industrializing agricultural Russia.

II

It has been said, with some justification, that "Soviet rule has bestowed upon science all the authority of which it deprived religion."[9] In the nature of a totalitarian society, this elevation has not been entirely an unmixed blessing. The regime's interest in and concern with science is at least two-fold. On the one hand, science is seen as providing the solution to the many scientific and technological problems the country is facing, and must thus be supported, encouraged and felicitated. On the other, as a "religion" it tends to be endowed with certain ideological overtones, or to come into conflict with certain aspects of official ideology (which claims to be scientific) and with official policies. This leads to serious impasses in which some scientists like Lysenko have managed to receive the regime's support for their views or theories.

This two-fold nature of Soviet science may be used as an explanatory principle for the understanding of certain happenings which have puzzled and often shocked the West and particularly Western scientists. Frequently, the tendency to look upon one side of this phenomenon has led to wishful thinking and often distortions of the value and validity of Soviet science and scientific efforts. Indeed, one might conjure the principle of a Maginot Line complex[10] in assessing, for example, the West's reactions to the whole Lysenko episode in biology and genetics and to some degree the theories of

[8] In 1913, only 17.6 per cent of the population was urban; the percentage did not appreciably change by the time of Revolution. *Narodnoe Khoziaistvo* (Moscow, 1956), p. 17.

[9] Remark by Edouard Herriot, quoted in "The Brahmins of Redland," *Time*, June 2, 1958, p. 22.

[10] "Lysenko did more harm to Western ballistics than to Soviet biology, for he encouraged scepticism in the West as to the position of science in a totalitarian state." Leopold Labedz, "How Free is Soviet Science?", *Commentary*, XXV: 472-480 (June, 1958).

Olga B. Lepeshinskaia[11] and of lesser known luminaries in Soviet science. Emphasis on these episodes has often led to a complete ignorance and dismissal of real scientific efforts and results until such a dramatic demonstration as the detonation of a nuclear device, then a thermonuclear one, then Khrushchev's boast of the possession of intercontinental ballistic missiles and the demonstration of their existence through the sputniks jarred the West. The co-existence of the Lysenko and other similar episodes and of important scientific achievements must be accepted as part of the Soviet scene, and there is no reason to believe that there will not be in science other Lysenko-like episodes and other sputnik-like developments, depending on the existence of different pressures upon the Soviet Union and on the internal dynamics of the country. In the long run, however, the Soviet leadership knows fully that when the chips are down ideological considerations must give way to scientific truth. For, as Ivan D. London so cogently pointed out:

> Ideology can be manipulated, but not practice; a thermonuclear weapon either explodes or it does not. The tough-minded leadership in the Soviet Union is interested in results, whether garnished or ungarnished with ideological greens.[12]

III

As we indicated earlier, the Academy of Sciences plays a leading role in the mobilization of Soviet science. The Academy is a large scientific bureaucracy, extremely complex in its structure, dominated by a small elite of academicians and corresponding members and consisting primarily of a series of research institutes affiliated with the Academy or its republican branches. The Academy is the main research arm of the regime and as such disposes of practically unlimited funds for projects which are of primary importance to the regime.[13] In addition, substantial research, primarily on practical and specialized problems, is also conducted in the institutes affiliated with industrial ministries. The proliferation of ministerial research institutes and the lack of coordination in their work as well as isolation from each other must have led to inevitable duplication of effort and waste of scientific manpower. As a result, early in 1957 a drive was initiated to cut down the number of specialized economic ministries and to reorganize their research institutes, either by combining them or by

[11] She believes that cells, instead of being derived from other cells (as Virchow demonstrated many years ago) also originate from undifferentiated organic matter.

[12] Ivan D. London, "Toward a Realistic Appraisal of Soviet Science," *Bulletin of the Atomic Scientists,* XIII: 169-173, 176 (May, 1957).

[13] When one Soviet physicist was asked by an American colleague the cost of an accelerator, the physicist said he did not know. "To get the money, all we had to say was that you had one." "Brahmins of Redland," *op. cit.,* p. 21.

relocating them under the jurisdiction of the newly created local economic councils—a part of the economic decentralization advocated by Khrushchev.[14]

Little research is conducted at the universities, which are primarily teaching institutions—a split of functions which is now being deplored in some Soviet academic and official circles.[15] Kapitsa, the leading Soviet physicist, has recently been advocating a plan which would be put into effect as some industrial ministries are abolished and decentralization takes place through regionalization. He holds that, up to the present time, institutes of research have carried on their work according to their field of knowledge, a natural and logical division. But now the need for solving increasingly difficult technical and scientific problems means the need to have scientists from different disciplines work on the same problem. These are called, in Soviet science, integrated problems. Hitherto, these problems have been solved by assigning the different parts to different research institutes with one institute assuming leadership. Kapitsa, however, feels that the basic shortcoming of such a system is the separation of scientists from each other and the resulting lack of personal contacts between them and the loss of enthusiasm and purposefulness. He therefore advocates the setting up of non-permanent scientific task forces for the solution of what he calls "specific urgent problems." He furthermore holds that such task forces will not require large funds but that a major difficulty will lie in the re-education of scientific and engineering personnel "who usually strive for stability in the work of their scientific institutions and are afraid to break from them." He says that such an organization may be visualized as a mobile combat task-force made up of units of the various services. "Such a force is assigned a definite operational assignment, after the completion of which it must be reorganized in conformity with the requirements of the next assignment." Kapitsa also expresses his conviction that the principle of organizing scientific work by problems should, in the future, become the basis not only for the solution of applied scientific and engineering problems, but also for tackling theoretical scientific problems "and should influence the organization of research work in the Academy of Sciences." He further indicates that the Academy of Sciences has recently and successfully made a start in that direction by pooling research work and scientists on dif-

[14] See his report on "Further Improving Organization of the Management of Industry and Construction," (7th Session of USSR Supreme Soviet) *Pravda,* May 8, 1958, pp. 1-5.

[15] At the 20th Party Congress, one of the slogans called for a greater role in research on the part of the universities. See Alexander G. Korol, *Soviet Education for Science and Technology,* (Cambridge: Technology Press of Massachusetts Institute of Technology, 1957), p. 370.

ferent "integrated" problems.[16] It is, of course, too early to determine whether the future of scientific research, and particularly pure research will be the one envisaged by Kapitsa. The present accomplishments of Soviet science are sufficient, however, to cause us to stop and examine in some detail the contemporary Soviet scientist and his position in Soviet society.

IV

Science, as a distinctive sort of human activity, exists primarily in the minds of scientists and depends for its continuance on the continued existence of a corpus of scientists. All the scientific knowledge accumulated by man would be of no use without scientists, motivated, in one form or another, to make use of this knowledge and to advance it through research. As such, the social conditions under which scientists are recruited, trained, work, interact with each other and live are of the utmost importance for an understanding of science. In one sense, the scientist lives and works in a special atmosphere—call it the social environment of science—where a change in pressure is likely to affect productivity and creativity. To take one extreme example: deprive a scientist of his laboratory equipment, notes, books, journals; forbid him contacts with other scientists, either personally or through publications; and attack him publicly by accusing him of being dishonest or disloyal; it is then fair to assume that his level of productivity will be low.

In general, the scientist's position in Russia has been the source of puzzlement to Western observers who find it difficult to reconcile his being attacked on unjustified grounds at times and his being elevated to the rank of hero at other times.

It may perhaps be possible to distinguish a gradient of immunity or susceptibility to ideological and political pressures, with the social sciences the most exposed and affected [17] and the physical sciences the least affected yet sometimes subject to attacks. Indeed, it might be said that of all fields of intellectual activity and professional en-

[16] P. L. Kapitsa, "Some Problems in Organizing Scientific Work," *Pravda,* May 4, 1957, p. 4; for an English translation see *Current Digest of the Soviet Press,* IX, No. 18, pp. 18-19.

[17] One might wonder, for one instance among many, how a Soviet historian can honestly deal with the Beria episode. Khrushchev, in a talk to a delegation of French socialists in 1956 bluntly asserted that the members of the Presidium, aware of Beria's plots against them, shot him during a session of the committee in the Kremlin. Officially Beria was condemned by a military tribunal and executed. But what is perhaps more frightening is Beria's becoming an "unperson." Subscribers to the *Large Soviet Encyclopedia* (the "B" Volume was published before his death) received a note from the publishers and an insert on the "Bering Sea," instructing them carefully to remove (with scissors or a razor blade) the pages containing a eulogy and portrait of Beria and substitute the insert. For the story of Beria's end see Bertram Wolfe, "How Beria Died" in *Stalin and Khrushchev's Ghost,* (New York: Praeger, 1957), p. 316.

deavors, the physical sciences, with some rare exceptions, are perhaps the freest areas of inquiry in the Soviet Union, particularly when compared with other scientific areas and professional fields, so that even "if the Soviet scientist lives in an ideological cage, the cage is a gilded one and within it there is more freedom and luxury than almost anywhere else in Russia."[18] This may, of itself, attract into such fields of endeavor many individuals of talent who find relative safety and quietude in those pursuits as well as satisfaction in their work. This may, furthermore, account for Soviet achievements in physics, mathematics and chemistry as against relatively poor showings in other intellectual fields, including biology (and particularly genetics which is only beginning to recover from the *Lysenkoism*) medicine, history, philosophy and literature.

We mentioned, earlier, the material rewards Soviet scientists receive as part of their emoluments. There is no doubt that these incentives are not only impressive by themselves, but particularly so when compared with what the average Soviet citizen receives and earns. It is precisely because the wage floor is so low, that the rewards of Soviet scientists are so out of line with what the average Soviet worker receives for his labor; indeed, the spread between the income of a scientist of high renown in the United States and that of an industrial worker is considerably smaller in the United States than in the Soviet Union. We are *in this respect* much closer to some kind of socialism than the Soviets.[19] As we mentioned earlier, the Soviet Union, after a few years of trying an equalitarian approach to rewards, found that this policy would not permit the rapid industrialization that was so vitally desired. Again, it was Stalin who attacked equalitarianism in salaries, saying that the "Leftist" practice of wage equalization was absurd in the conditions of the time and that it made no sense to pay "a rolling mill hand no more than a sweeper . . . a railway locomotive driver . . . no more than a copying clerk." How could one under those circumstances expect the sweeper to be motivated to improve his skills and qualifications since he would get nothing for his pains?[20] Differences in wages among manual workers were accompanied by differentials to separate them, in turn, from intellectual workers. This led to various styles of life for differently positioned individuals, including the differential granting of social honor and prestige. The

18 "Brahmins of Redland, *op. cit.*, p. 21.

19 Any interested reader might, for his amusement and his enlightenment, make a ratio between the average wage of the American manual worker and that of the average American professor. This ratio would be in the vicinity of 1:5. The same calculations in the Soviet Union would yield a ratio of at least 1:10. Additional incomes derived from holding more than one official position, royalties, publication and speaking fees and other emoluments would easily boost this ratio to 1:20 or even 1:25.

20 "New Conditions and Tasks in Economic Construction," in *Problems of Leninisms, op. cit.*, p. 372.

scientist is *not* therefore unique in Soviet society in receiving more and better rewards and prestige than others; in this he shares approximately the same position as artists, composers, ballerinas and other members of the Soviet occupational and professional élite (this to be distinguished from the power élite who are in a category of their own).

It is not necessary here to detail the different elements that make up the standard of living and of prestige that attaches to the Soviet man of science; they have been duly reported in the American press. But perhaps we might point to some of these elements and to their implications, particularly under Soviet conditions. Thus, for instance, housing (i.e. the possession of a personal apartment which does not have to be shared with other families) provides an extremely scarce facility in Soviet society—privacy, not only for oneself and one's family, but also the ability to entertain others, to meet with fellow scientists quietly and without interruption. The possession of a car in Soviet society also symbolizes high status and provides a rare commodity: private and comfortable transportation, often with a chauffeur thrown in; paid vacations in luxurious health resorts; medical care of superior quality; good clothing; summer houses in addition to private apartments; all this plus high income frees the scientist from financial worries and permits him, presumably, to devote his time and energy to the exclusive pursuit of science. Honors, prizes, medals and citations further reinforce his prestige in the eyes of Soviet society, whose high priest he has become. Yet, one might wonder if these emoluments are enough to explain Soviet scientific successes and the creativity of Soviet scientists. Would Soviet scientists perform less well if their *dachas* were taken away from them; if their incomes were cut down to a fraction of what they are; if they did not receive the Order of Lenin for important contributions? The answer, except for a small minority of mediocre scientists, is undoubtedly no. For science and scientific work is a vocation which carries its own built-in rewards, and which provides its own self-sustaining and self-rewarding motivation. As Richard Hughes pointed out, comparing the Economic Man and the Professional Man:

> The Economic Man sells his labour, at a rate of money. Work is something he is prepared to do, in fair proportion to the money he gets for it. His working day is the number of hours he is willing to waste, in order to have the wherewithals to live and to enjoy his leisure. The man with a profession also calls what he does 'work:' but his meaning is exactly the opposite. It is the hours he is not working he considers wasted. Pay? Of course he expects to be paid: a man cannot live on air. But whereas the Economic Man looks on work as the means to get money, the Professional Man looks on money as the means to do the work.[21]

[21] Richard Hughes, *In Hazard* (London, 1938), p. 169.

High material rewards thus would not motivate true scientists whose one important operational principle is disinterestedness.[22] "Scientists as a class," according to Frederick C. Irion, "are not strongly economically motivated . . . at Los Alamos [they are] apparently contented with home which third-rate dealers in second-hand cars would find somewhere between inadequate and intolarble."[23] (This should not be construed as encouraging the payment of low salaries to scientists.) Economic rewards may, however, motivate those who are young and undecided about a career. The Soviet scientist is seen as one who is not only well paid by also respected,, admired and honored; he is a sort of hero, much more indeed than the manual worker or the peasant who in the workers' state is often contemptuously dismissed as being *nekulturnii* (uncultured).

It is therefore *at the recruitment level and not the performance level* that the high value that attaches to scientific work may be most significant. The scientist becomes a role model that young people become eager to imitate and emulate. High material and honorific rewards thus acquire *symbolic* significance of the society's appraisal of this type of activity. The pictures which flash across the motivational horizon of the Soviet youth are thus somewhat different from the ones that streak across that of the young American. In Soviet society the cultural hero is often pictured as the tireless scientist who toils ceaselessly in his attempt to improve production or the lives of people or to make an important contribution to knowledge. The scientist is further depicted as one who is not really motivated by material rewards and may even be embarrassed by all the fuss and bother and special privileges given him.[24] The only fly in the ointment, however, is that the

[22] This is only one part of what Robert K. Merton calls the "ethos" of science or the affectively toned complex of values which are held to be binding on the man of science (prescriptions, proscriptions and permissions). Beside disinterestedness, Merton also distinguishes three other elements of this ethos—universalism, communism, and organized scepticism. Robert K. Merton, "Science and the Democratic Structure," in *Social Theory and Social Structure,* (Glencoe, Ill.: Free Press, 1949), p. 309.

[23] "Sir Nuclear Fission: A Realistic Myth," *Bulletin of the Atomic Scientists,* XII (No. 5), p. 180.

[24] There is in Russian culture a strong streak of equalitarianism. This translates itself in the inability to enjoy privileges when one know that others do not have the same ones. An example from the recent literature is a scene in Pasternak's *Doctor Zhivago,* in which he describes a party, with duck and vodka in Moscow at a time when there was almost no food to be had ". . . their party was a kind of betrayal . . . only a life similar to the life of those around us, merging with it without a ripple, is genuine life . . . an unshared happiness is not happiness . . . duck and vodka, when they seem to be the only ones in town, are not even duck and vodka." (New York: Pantheon Press, 1958), p. 175. Patricia Blake in a report on the Soviet scientific élite indicates that privileges and luxuries naturally delight physicists "yet somehow they do not seem quite comfortable among all the trappings the government has provided to keep them happy . . . they may feel a little guilty not to be able to share their good fortune with their families and friends back home." "Russia: The Scientific Elite," *The Reporter,* November 14, 1957, pp. 17-19.

system of powerful material and honorific incentives may attract into science individuals who are primarily interested in the rewards rather than the scientific work itself.[25] It must be assumed, from the results achieved by Soviet science, that these individuals are not in the majority.

In addition to the inner rewards and satisfactions derived from the nature of the work itself, the scientist may well feel, in the conditions of Soviet society, that he is helping in the building of a new society, that he is a leader in pointing the way to the future, in other words, that he is helping his people and his country. "An aspect of the cultural tradition (of Russia) is stress on service to the group as the appropriate motivating force for an intellectual, instead of financial gain. This tradition is by no means a Soviet creation and has strong roots in the Russian past."[26] And however much he may dislike the regime, particularly the obtuseness of some of its leaders, he still loves his country and his people, he has the satisfaction of being convinced that he works for their interests and he enjoys the recognition on the part of all of his high status and therefore the recognition of the importance of his occupation. In pre-revolutionary Russia there was much preoccupation among the intelligentsia with the "superfluous individual" (*lishnii chelovek*). The Soviet scientist is made to feel that he is anything but superfluous: he is wanted, needed, his role has a well-defined, clear, and socially supported function. As such he derives perhaps more pleasure from his work than any other individual in Soviet society and certainly a keener sense of accomplishment than most other intellectuals and professionals.

Paradoxically enough, even the ideological pressures to which all Soviet citizens are subject may contribute to science and scientific

[25] This undoubtedly takes place in Soviet society, as one can gather from certain literary descriptions that appeared at the time of thaw, in 1956 and 1957. Scientific hacks, apparently, find their way in the large scientific bureaucracy that the state has erected to support and control the work of scientists, and they often use their influence to harass (as only bureaucrats can) those who do the work of research and discovery, or to appropriate honor, through ideological and administrative manipulations. It is particularly interesting to note that criticism in the recent literature tends to focus, in particular, on the important process of *application* rather than *discovery* and with the difficulties that beset innovators and inventors when they attempt to put their findings into practice. For a description of the scientific bureaucracy in its less savory and obstructionist aspects see Venianin Kaverin "Poiski i Nadezhdi," (Searches and Hopes) *Literaturnia Moskva, II,* 1956; Vladimir Dudintsev's novel, *Not by Bread Alone,* (New York: Sutton, 1957), and the following two articles: George Gibian, "The Image of the Scientist," and Gustav Wetter, S. J., "Dialectical Materialism and Natural Science," *Survey,* 23, Jan.-Mar., 1958.

[26] Barrington Moore, Jr., "Strengths and Weaknesses of the Russian System," Interim Report, Russian Research Center, (Cambridge: Harvard University Press, 1952), pp. 38-39.

creativity. Soviet intellectuals often describe their work as their "internal or inner emigration," an area into which they can plunge and immerse themselves, far away from the more infantile demands of the regime, the drabness and the shabbiness of the everyday Soviet scene. Of all intellectual occupations, science apparently offers the safest of the inner emigrations. The dangers of such emigration in literature are only too well illustrated in Boris Pasternak's fate, not only with regard to the Nobel Prize, but also some of his other poetic works which have been written "for the drawer" and never published.

In its appraisal of Soviet science, the West and particularly the United States have gone from one extreme to another: from the age of arrogance to the age of humility. The tendency now is to overestimate Soviet science just as much as we underestimated it a few months ago. What is needed is not an agonizing, but a sober appraisal of Soviet science and particularly of the implications it has laid at the doorstep of American society and its way of life.

V

If we go back, for a moment, to the concept of a world system, in which developments in one country are always potentially relevant to the other countries, then it is clear that Soviet industrial development and scientific accomplishments pose a definite problem to American society. This problem is two-fold: one is the obvious strategic implications of an unbalance of power in favor of the Soviet Bloc, with all the consequences this may have for the future of America as an independent nation. The other question, more difficult to analyze and assess, is the implications of Soviet power for the very nature and fabric of American society. The tendency when two opponents face each other is, for the one who feels his weaponry is inferior, to adopt the same weapon as his protagonist, or a better one if possible. Thus, if for the sake of efficiency and power, we begin to mold our society along the lines which apparently enabled the Soviet Union to accomplish what it did and in such a short period of time, if in other words, we tend to become but a mirror image of that society, we will then have lost the struggle by losing our system of values for a mess of power pottage. The real challenge to a democratic nation is to become strong while remaining true to its ideals, and not to succumb to the lure of the efficiency experts and their blandishments.

The crisis of America at the mid-century is not solely or particularly a crisis of science, but a crisis of the intellect. We are perhaps still suffering from the after-effects of "the profound anti-intellectualism of the frontier, in itself the outcome of a practical versatility

which knew little of books . . .''[27] The frontier has been closed now for almost a century, but the myths still linger on, feeding generation after generation with the hackneyed stereotype of the intellectual: the impractical, bumbling theoretician, the unattractive book-worm, the horn-rimmed high domed egg-head, the underpaid and overworked teacher and professor, the man who could not meet a payroll, score a touchdown, fight his way out of a brawl, or afford a smart two-toned convertible. Yet, as Alfred North Whitehead once pointed out, ''In the conditions of modern life, the rule is absolute: the race which does not value trained intelligence is doomed.''[28] The future of America does not lie in the hands of the football and baseball heroes, not even in the hands of smart businessmen but in the heads of our trained men and women of intelligence. Furthermore, if we assume that innate intelligence (potential intelligence) exists randomly among the members of the population, then the task of a democracy that wants to survive is to make sure that this potential talent is identified wherever it may be and given the necessary training so it can be useful to our society. This implies, of course, an overhauling of our educational system and strong infusions of federal support. The American school system belongs to an age that is already past, with its lack of national standards, the unbelievable differences in amounts spent per pupil from state to state and its reliance on the local community with its obsession on the tax rate. The challenge to our society and our schools is to identify and train men of intelligence wherever they may be found within the framework of our democratic institutions and without resorting to the loss of intellectual freedom that has been the lot of the Soviet Union.

But of even greater significance for American science and society is the need for a rebirth of respect for the mind, a respect that was high in the America of Jefferson but has tended to be blotted out by the experience of the 19th century with its rapid territorial expansion and the preponderant role that the ''hand'' rather than the ''head'' played in this development. The frontiers that remain now are the frontiers of science. While the tinsel and glory of money and prestige may be important in symbolizing the respect in which an occupation is held by a society, the scientist derives his satisfactions from deeper wellsprings; his occupation is, as we said earlier, not so much a means to a livelihood as a ''vocation''.[29] As a vocation it must

[27] Harold J. Laski, *The American Democracy,* (New York: The Viking Press, 1948), p. 270.

[28] Quoted in the *Salem College Bulletin,* Spring, 1958, p. 32.

[29] The expression is from Max Weber, "Science as a Vocation," in *From Max Weber: Essays in Sociology;* translated and edited by H. H. Gerth and C. Wright Mills, (New York: Oxford University Press, 1946), pp. 129-156.

be sustained by deep emotional commitments and motivation that can be imbued to the future scientist by those who mold his personality in the formative years: his parents. This molding cannot take place unless there is in the culture, in the values of our society, in the means of mass communications, in the thought patterns of the average individual, not necessarily an *understanding* of what scientific and intellectual works are, but an *appreciation* of their importance, a respect for those who carry on this type of activity and a conviction that to stand out intellectually is not any more undemocratic than to excel at sports or business. As free men, the probability of successfully meeting the Soviet challenge is in the balance; as free, intelligent and trained men, this probability more nearly approaches certainty.

THE POLITICAL IMPLICATIONS OF INSPECTION FOR DISARMAMENT

By Seymour Melman

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Highly significant political opportunities have been opened up by the possibility of carrying out scientifically reliable inspection for disarmament. The possibility has been revealed by the scientific findings of recent investigations under the Institute of War and Peace studies at Columbia University. The results of the investigation indicate how international disarmament agreements can be implemented even in the presence of the international distrust which has been growing throughout the years of the hot and cold war. The results of the investigation have been set forth in the book *Inspection for Disarmament* (New York: Columbia University Press, 1958). The purpose of this article is to review the scientific methods as well as the political opportunities for international disarmament inspection agreements.

I. Reliable Inspection Is Technically Feasible

The critical method of the investigation of inspection for disarmament was the effort to define crucial control points by which production of critical weapons could be reliably controlled. In this study, an effort was made to cope with the most difficult kind of disarmament problem, extensive types of agreement which would require reliable control over production of the most intricate materiél—long range intercontinental missiles.

Throughout the investigation an effort was made to utilize a multiple approach to each particular inspection problem. By this means the relative weaknesses of any particular approach could be compensated for by the possibilities of alternative methods. Thus, control over the production of certain instruments could be carried out by monitoring raw materials, production equipment; and the location of key technical personnel.

Owing to the extensive development of weapons technologies during recent decades there exist many opportunities for various kinds of

disarmament agreements. Thus, our findings are pertinent to agreements on nuclear bomb-testing, control over high-altitude missiles testing, aerial inspection, production of fissionable materials, production of biological warfare elements, and production of long-range missiles and their various components.

When each of these elements was examined separately it was found that with reasonable outlays in manpower and equipment highly reliable systems of control could be set up to give mutual guarantees to the signatories to disarmament agreements. Our findings on the subject of nuclear bomb-testing, for example, were substantially confirmed by the recently concluded international meeting of technical representatives from the United States and the Soviet Union in Geneva.

The technically workable steps in disarmament agreements could be implemented at relatively modest cost in manpower material. The following table from *Inspection for Disarmament* gives a series of estimates of the direct field force that would be required in the continental United States for implementing the indicated types of disarmament inspection.

ESTIMATES OF THE NUMBER OF PEOPLE NEEDED FOR POSSIBLE ASPECTS OF INSPECTION FOR DISARMAMENT WITHIN THE UNITED STATES[1]

Type of Inspection	*Field Staff*
Aerial Inspection (Assuming 3 million square mile area. Including air crew, maintenance, and photo-interpreters).	550-750
Stations for Monitoring Nuclear Bomb Testing (15 stations: field and analytical staff)	225
Stations for Monitoring High-Altitude Missile Tests (15 stations — field and analytical staff)	180
Nuclear Reactors (300, including experimental and planned)	600-1,500
Fissionable Materials-Producing Plants (6 plants)	300-2,400
Uranium (and Vanadium) Mines and mills (637 in 1954)	1,200
Aircraft Assembly Plants (72 in 1954)	700-1400
Aircraft Engines and Parts Plants (234 in 1954)	2,400-5,000
Aircraft Flight Instruments Plants (129 in 1954)	1,300-2,600
Radio and Radar Plants (225 in 1954)	2,250-4,500
Ordnance and Accessories Plants (493 in 1954)	5,000-10,000
Exposives Plants (74 in 1954)	750-1,500

[1] These estimates were constructed on the following bases: for aerial inspection and bomb and missile testing, the authors estimated the field staffs required for 24-hour functioning; checks on reactors could be maintained by as few as 2 to 5 men per reactor, depending on the need for 24-hour monitoring; in the fissionable materials plants, the range is due to readiness to rely on instrument monitoring vs. major reliance on human controllers; mines and mills could be covered by an average of about 2 men to each mill or mine; the various critical factories for missiles, aircraft, and explosives could be monitored by an average of 10 to 20 men per plant. Such estimates give an order of magnitude. They would be revised in accordance with detailed operating requirements of an international inspectorate.

Sampling inspection could be made in the following areas: i) biological laboratories; ii) metal-working plants; iii) U.S. government accounting; iv) scientific manpower.

Clearly, extensive disarmament inspection in the vast industrial complex of the United States could be carried out with the total requirement of about 40,000 men. The types of agreements which could be used for initiating the development of international disarmament could be carried out, as indicated, with a rather modest outlay in manpower.

II. Evasion of Inspection

Another major aspect of the study of the inspection for disarmament was the diagnosis of necessary conditions for successful clandestine evasion of disarmament agreements. Through studies of such efforts in Weimar Germany and in Palestine under the British Mandate, it was possible to infer a theory of successful evasion, which indicates the requirements for frustrating such evasion. Successful evasion, it was found, could be carried out if three conditions were satisfied:

A. A group of men exists which is prepared to carry out the clandestine production even at the cost of considerable personal sacrifice and risk. These men have strong allegiance to a guiding ideal.

B. The central working group is backed by a substantial part of a population, including a government or quasi-government, which backs up the operating groups and shields them from the inspecting authorities.

C. The operators of the clandestine production system learn how to simulate appearances that will seem to be ordinary and innocent in the eyes of the inspectors.

Where any one of these critical conditions is lacking or can be frustrated by an inspection system, the opportunity for successful evasion of inspection for disarmament is substantially curtailed.

The combined analysis of technique for evasion and for inspection yielded the judgment that the reliability of disarmament agreements is likely to improve with each particular success. The reason for this effect is indicated by the following reasoning from the general report on inspection for disarmament:

> Successful inspection, like successful evasion, requires more than technical feasibility. In the judgment of this writer, the final line of defense against evasion will be a condition of society in which such acts are widely regarded as unnatural and unthinkable. Even if some deadly weapons systems could be operated by as few as six men, those men could not make a military campaign; that would need the collaboration of at least a segment of a population. In this respect, the presence or absence of an "evasion mentality" could play an important part.
>
> Toward the end-in-view of diminishing or discouraging an

evasion mentality, the early implementation of even partial steps for disarmament and international inspection is of the greatest importance. For every measure that relieves international tension and limits the fever of an arms race also limits the conditions that produce an evasion mentality. Stated differently: the introduction of particular disarmament measures in regard to highly destructive weapons, with reliable inspection, is bound to have a feed-back effect in reducing the pressures that lead to clandestine armament preparations. Thereby, conditions of mutual international assurance of compliance with disarmament agreements are improved.

The new knowledge at hand on the technical feasibility of inspection for disarmament clearly opens up political possibilities. This knowledge becomes important for political analysis, and for negotiation, in order to exploit to the fullest the political possibilities which inhere in international disarmament agreements. These opportunities involve a major alternative to the strategy of military deterrence which has dominated the international political scene.

III. The Failure of Military Deterrence

In the judgment of this writer, the strategy of military deterrence, a cornerstone of American foreign policy, now has major defects: the dangers of accidental triggering of nuclear wars are increasing; the addition of new countries to the nuclear weapons group vastly complicates the task of identifying an aggressor; possession of a clear lead in the arms race has become an improbable event; limited wars between the major powers have become less probable, leaving unlimited nuclear war the most likely event in a military contest.

A. Weapons Out of Control

The very existence of weapons of mass destruction in large quantity opens up possibilities for these intricate military technologies going out of control. In the preface to *Inspection for Disarmament,* I indicated that:

> Undoubtedly, the designers of nuclear weapons have attempted to build into them certain mechanical safeguards against accidental firing—such as the requirement for a deliberate adjustment before such weapons become operative. There are no final safeguards, however, against the probability of human failure. As nuclear weapons are produced by the tens of thousands, and must be used by even more than that many men, the possibilities of world disaster through human failure cannot be ignored. One aberrant, psychotic person, or person gone momentarily out of control, could explode nuclear weapons at a random place, or over any populated area. A space satellite could be mistaken for a ballistic missile.
>
> Since military tactics and technologies have become geared to the idea of rapid retaliation, such accidents would require only one misjudgment in response to set the swift moves and countermoves of

catastrophic nuclear war in motion. As nuclear weapons are increasingly available and dispersed in more hands, the probabilities of such an accident must necessarily increase. In the judgment of this writer, such possibilities weaken the assumptions of rationally calculated moves among military powers, which underlie the strategies of peace through mutual armed deterrence.

B. New Countries With Nuclear Weapons

One of the major assumptions of the mutual deterrence strategy will be drastically altered when many countries possess nuclear weapons. If a warhead should be set off in some city, it might be impossible to identify the aggressor, because of the number of countries possessing bombs, and the variety of possible ways for delivering nuclear explosives. Unless the aggressor were known, it would be clearly impossible even to threaten retaliation. Thereby, the strategy of a "balance of terror" fails as a way for deterring nuclear attacks.

Not many months ago, there was an accidental detonation in a Nike battery of anti-aircraft missiles in New Jersey. Since missiles of this sort may be equipped with nuclear warheads it is reasonable to speculate on the possibility of accidental detonations of such a battery of missiles.

The information reaching a military headquarters would be that a series of nuclear exposions have occurred in the New Jersey-New York area. There could be no indication as to the precise source of such explosions owing to the fact that nuclear warheads may be delivered to many points on the earth's surface by a great variety of means. These methods for delivery range from suitcase bombs to warheads encased in long-range missiles. At this writing, if the possibility of an accident were ruled out, military commanders might infer that the only possible source of such nuclear blasts was the government of the U.S.S.R. Accordingly, retaliation might be ordered.

In the foreseeable future, however, many nations will possess nuclear warheads. Then it becomes virtually impossible for any military group even to discover the source of control over such a nuclear blast. When the identity of a possible aggressor cannot be established, it clearly becomes impossible to carry out acts of retaliation, which are a necessary part of a strategy of military deterrence.

IV. A Decisive Lead in the Arms Race Has Become Improbable

The development of many alternative military technologies, in parallel, virtually excludes the possibility of any major power assuming a clear lead over the other in military technology. Where weapons systems must draw upon all the natural sciences and their range of engineering applications, it is reasonable to assume that there must be variation in the rate of development in these arts if only as a function of accidental factors of personality among the thousands of men

engaged in such work in various countries. Moreover, both the United States and the U.S.S.R. are large countries, each able to devote thousands of able technical men to military tasks. It is unlikely that either country can develop a clear lead in technical intelligence. Nuclear warheads, for example, may be delivered by many alternative ways. It is virtually excluded for any one country to hold a clear lead with respect to all of these alternative possible ways. This is a critical affair because even one technique for delivering nuclear warheads could be sufficient to cause very great destruction. So long as one of the contenders in the arms race can utilize one of the available methods, the possibility of either side obtaining a clear military lead is virtually excluded. As a result, no military staff is now able to advise the government of a major power as to the sufficient steps for obtaining a military victory, either offensively or defensively.

At the very same time that military technologies have so developed as to yield a military impasse, with mounting dangers of accidental triggering of nuclear wars, these military developments have not served to deter the extension of the Soviet system. The government of the Soviet Union has proceeded to use political and economic methods for extending the scope of its rule throughout the world at the very same time that the arms race has developed into a military impasse. Accordingly, the military strategy of deterrence has failed in its avowed objective.

V. Limited Wars Among the Two Major Powers Are Unlikely

Finally, it is essential to underscore that limited wars are an unlikely event among the major powers. In the U.S.S.R. there is a tradition that militates strongly against military surrender. After World War II, Russian soldiers who had surrendered to the German army were severely punished for that act. In the United States, the recent discussion in the Senate on researches concerning possible strategies of surrender had the result of giving a fairly clear political directive to military commanders: surrender is not to be regarded as a reasonable, admissible act by senior military commanders of the United States.

Under these conditions, with surrender being excluded for senior Russian or American military commanders, any war in which these two military staffs are pitted against each other must soon change from a limited war by conventional weapons or tactical nuclear weapons, into an all-out nuclear war. As either side faces the danger of possible defeat, it must bring up the more powerful weapons needed to forestall such defeat, with its impermissible accompaniment of surrender. In that way, a conflict that began as an apparently limited military contest could develop into a world-wide holocaust.

Recent discussions of alternatives facing the United States have been formulated in terms of possibilities of surrender versus annihilation. In this writer's opinion, this formulation of alternatives is altogether realistic within the context of the general strategy of military deterrence. Indeed, there is only one way to escape such alternatives, and that is to adopt a different general political strategy which opens up new possibilities in international behavior.

VI. Political Opportunities in Inspection for Disarmament

International agreements that include systems of mutual inspection mean that distrust need no longer be an overwhelming obstacle to international agreements on particular disarmament elements. As a result there probably exists a new condition of political feasibility for disarmament agreements.

Agreements on particular disarmament matters necessarily do much more than cope with the particular matters involved. The implementation of each particular disarmament agreement produces a change in the situation within which the next step in disarmament must be taken. Just as each step of conflict and irritation during the cold war increased international distrust and tension, so would each success in international disarmament diminish distrust and tension.

It is, of course, possible to make the assumption that the Soviet Union or the United States, or both, represent substantially monolithic systems from the standpoint of international political agreements. When such an assumption is made, the effect is clearly to close off opportunities for almost any kind of agreement, for then one would give primary attention to the cold war history with its accompanying international deterioration. In the judgment of this writer, altogether different possibilities open up when one asks the question: What are the internal political effects within the Soviet Union and the United States from concluding particular disarmament agreements? What types of changes would be favored in each country by this situation and who would benefit from such changes? In the U.S.S.R., for example, the history of international tension has been a major device for justifying the maintenance and extension of dictatorial and brutal types of political control. The relaxation of international tension would favor those elements in Soviet society who themselves want a freer life.

This subject surely deserves the most extensive examination by political scholars, for the exploration of this area of results from inspection systems might very well open up hitherto unseen opportunities and effects from international agreements. Thus, it is entirely possible that scientists in the U.S.S.R., as a group, are disposed to favor

international disarmament agreements, for such agreements would lay the basis for less political control over their occupations.

Disarmament and the promise of alternative use of vast human and industrial resources for peaceful purposes opens up the opportunity for a grand strategy that could very well have the most desirable effects throughout the world.

VII. Political Barriers to Disarmament Agreements

It is possible to pinpoint a number of factors which block international agreements on inspection for disarmament. These include: an atmosphere of distrust and a tradition of evasive practices; occupational commitments to the arms race; the argument of relative military weakening as a result of disarmament; disarmament as a hazard to authoritarian practices; uninspectability of secret arms caches; and finally, the demand for foolproof inspection systems.

A. Distrust and Evasiveness

Probably the most important single factor that militates against successful disarmament agreements is the development of fearful evasiveness as a common pattern of behavior in politics, and in other aspects of life as well. This factor is important in view of the considerable range of alternative technical possibilities in weapons systems that are open to military planners. In the presence of a widespread will to evade a disarmament agreement, coupled with the other necessary conditions for evasion which were cited above, the possibility is open for seizing upon one among many military technologies for designing and utilizing weapons of high destructiveness. Accordingly, the subject of evasiveness as a general feature of human behavior was given explicit attention in the study of inspection for disarmament.

Dr. Alberta B. Szalita wrote, in summing up her paper:

> The success of a disarmament agreement depends upon trust among peoples. Mistrust and evasiveness in individuals are the outcome of fear, loneliness, threats to security, lack of love, humiliation, helplessness, and the feeling of uselessness. When a society generates such effects as common conditions of life, then evasiveness and its concomitant ways become widespread and even acceptable features of behavior.
>
> Similarly, the need for, and hence receptivity to, "evasive" behavior and destructiveness can be mitigated. This occurs when conditions of living generate a widespread feeling of being needed and useful, and the allied senses of security, self-respect, and well-being.
>
> Under such changed conditions, evasiveness and destructiveness would become unnecessary.

A lessening of distrust and evasiveness would be a major derived effect from successful inspection for disarmament.

B. Occupational Stakes in the Arms Race

In every large country there is now a major labor force commitment to military design, production and application. This job stake in the arms race is another major source of pressure against the implementation of disarmament agreements. In the United States in 1956, it is estimated that about 15 per cent of the labor force was engaged in work on military orders. Such employment is concentrated in the capital goods industries.

The scientific and technical occupations are also especially effected by the emphasis on military related work. Various estimates indicate that the military budgets account for the financing of 30 to 50 percent of all scientific and engineering research in the United States. These factors indicate the existence of a major human problem, for it means that many millions of men and women have developed occupational competence that is especially suited for weapons technologies. A major effort to shift away from the arms race necessarily entails a systematic effort to cope with the retraining of these people and the utilization of their capabilities for peaceful purposes. Moreover, it is only human to expect that these people will have developed a picture of their own worth in the community which is closely linked with the kind of work that they do. Accordingly, it is reasonable to expect that the people in these occupations, ranging from the worker on the plant floor to the highest paid executive, will seek to justify and continue the activities in which they have gained success in their livelihood. This suggests that the availability of practical plans for coping with a changeover to peacetime activities would itself play a part in curtailing the arms race.

C. Relative Military Effects From Disarmament Agreements

From a military standpoint it is often urged that no disarmament steps be taken which weaken one's own government in relation to international rivals. Such reasoning clearly assumes an ability to determine what military acts are in fact decisively advantageous—as among the major military powers.

I wish to argue that such calculations of relative military advantage are no longer possible. In detail: Nuclear warheads of major destructiveness can now be delivered by various ways, ranging from intricate missiles to the suit-case method, which bypasses many military defensive systems. As a result of such capabilities, no military staff is able to specify the sufficient actions to produce success either in offensive or defensive strategies. If this were not the case, if the necessary actions for military success could be specified, then it might be argued that a calculable military weakness would follow from the absence of some area of particular weapons capability. Such calcula-

tions cannot be made, however, owing to the alternative available methods by which nuclear warhead destruction can be applied. Accordingly, given the availability of nuclear arms systems, the argument of relative military disadvantage as a reason against particular disarmament steps becomes difficult to sustain. Similar reasoning is relevant to various non-nuclear weapons systems. Broadly, disarmament agreements which bear closely on one among many weapons technologies leaves a residue of military possibilities untouched.[2]

C. Secret Arms Caches

International discussion of disarmament possibilities has frequently turned to the problem of secret arms caches. In a word, the fear is that the arms race has proceeded so far in many countries that secret stockpiles of arms could be (or already have been) put away before the inspection system for policing disarmament agreements goes into effect. Thereby, a weapons potential could be at hand despite the operation of even the most elaborate of inspection systems.

This possibility is altogether reasonable. It is realistic to assume that various military groups in each of the major powers would see to it that secret arms caches existed at the every time that disarmament agreements were being concluded and implemented. In the judgment of this writer, the critical question involved here is: Does the existence of secret arms caches, known to a relatively few persons in each of the major countries constitute a sufficient differential threat among the major powers to cause refusal to engage in disarmament agreements? Does a weapons stockpile necessarily equal military capability?

The early phases of disarmament agreements would clearly pertain to only certain sections of the available military technologies. Thus, agreements on nuclear warhead testing and high altitude missiles testing would leave in being the existing stockpiles and even production of missiles and weapons. As disarmament agreements encompassed more of the major military technologies and were successfully extended from one sphere to another, one of the major accompanying effects would be the gradual growth of mutual trust and openness among the peoples of the earth. Under such conditions, the existence of secret caches of arms known to a few conspirators in each country could not constitute a major military threat to other countries of the world.

True, it is technically possible for a few men to deal a heavy physical blow through the use of highly destructive weapons. How-

[2] The interested reader will find illuminating confirmation of this thesis from an examination of a recent report of the National Planning Association entitled "1970 Without Arms Control" (National Planning Association, May, 1958).

ever, such an attempt becomes less probable as the political atmosphere in which such acts are regarded as natural and reasonable is altered, and the use of highly destructive weapons becomes increasingly an unthinkable, inhuman act. Furthermore, a heavy physical blow dealt by a few men does not constitute a military campaign. Such a campaign, aimed at taking over control of a major area of the earth requires the co-operation of millions of men. As the atmosphere of international fear and evasiveness is altered by the progressive extension of disarmament agreements, it necessarily becomes more difficult to secure such co-operation. Accordingly, a conspiratorial group, even heavily armed with nuclear weapons, thereby becomes effectively isolated as a military factor.

The weapons of secret arms stockpiles become a military factor only when there are large numbers of men who are willing and able to use them and have the backing of a major portion of society. The effect of progressive disarmament linked to appropriate inspection would be to diminish the conditions of social readiness which are necessary for rendering secret arms into operational weapons.

The gradual extension of international disarmament agreements will very likely involve, at some point, the establishment of an international military force. As such a force becomes important, relative to diminished national military establishments, the availability of secret arms caches in any one country necessarily becomes less of a military factor in terms of relative strength.

Finally, the meaning of a secret stockpile of arms needs to be examined in terms of a characteristic feature of modern weapons technology, namely the availability of many alternative ways for accomplishing highly destructive tasks. At the side of the destructive capability inherent in nuclear warheads, there are the possibilities of biological warfare utilizing micro-organisms or chemical agents. Biological warfare opens the possibility for highly destructive weapons being fashioned by relatively few men, with relatively primitive equipment.

In light of this analysis, I am compelled to the conclusion that the most important possible secret arms cache resides in the capability of human beings for making and using various types of destructive weapons. Owing to the many technologies which can be seized upon for destructive application, it is clearly the will of man to utilize his knowledge in this way, that is the critical weapons stockpile under modern conditions. In a word, the most dangerous military stockpile, the one most easily concealed, is the capability for making and using deadly weapons that can reside in the hands of determined men who are trained in modern technology and have the will to utilize this for destructive ends.

By this reasoning, the final line of defense against secret stock-

piles must reside in the necessarily changed social atmosphere which would result from successful extension of disarmament agreements. Under present-day conditions, the greatest source of danger to mankind comes from the recognized willingness of people to fabricate and to apply weapons of mass destruction. Similarly, the safety of mankind will derive from the social atmosphere in which such acts are regarded as inhuman and unthinkable. Indeed, as such an atmosphere develops, the very existence of secret bombs caches becomes increasingly difficult to sustain. For the thousands of people who are needed to produce and then place large numbers of intricate weapons will very likely contain at least single persons who, in due course, could not bear the burden of being a party to the mass destruction of other human beings. Secret stockpiles of weapons, if they existed, would then be exposed.

D. The Hazard To Authoritarian Practices

Inspection for disarmament could lead to increased openness of society, as an inescapable requirement of the inspection process through more comprehensive agreements. This would result from the need for freedom of access to various types of premises, especially for controlling against illicit weapons production. As a result, internal security systems of all kinds would be pierced. These effects would remain even where inspection were carried out only by a formal agency. Such results would multiply if the methods of "Inspection by the People" were applied.[3]

Indeed, the internal political effects from the operation of inspection systems probably give the clue to understanding the reluctance of various Soviet leaders to enter into such agreements. In my estimate, it is the inspection part of the nuclear test ban agreement that troubles them. An agreement on inspection by international teams would set a precedent whose internal effects would run counter to tight, unilateral systems of political control within the Soviet countries.

That does not mean, in my opinion, that the Soviets will necessarily continue to turn down inspection agreements. Pressure in that direction is bound to come within the Soviet sphere from the many people who could gain in their own freedom from a relaxation of international tensions and the reduction of internal police controls.

E. The Demand For Foolproof Inspection

The demand that inspection systems must be foolproof to be acceptable is tantamount to a rejection of the idea of inspection. For

[3] See *Inspection for Disarmament, op. cit.*, pp. 38-44.

no such absolute condition of perfection is known in any sphere of man's knowledge or activity. There are always limits to accuracy. Variability and errors of estimation are characteristic of all observations of phenomena. Within such limits, we all do things that are useful and workable and predictable, though never perfect. We put insulation on wires and brakes on automobiles because they are workable, and we are vastly better off for having them despite occasional flaws. That is the understanding which is indicated for inspection systems. With such ends in view we can utilize and enhance the available inspection technique.

VII. Alternative To The Arms Race

While calling a halt to the international arms race is an important end in itself, the steps necessary to achieve this goal give rise to a range of allied problems.

What use should be made of the human and material resources in the United States which are now devoted to arms development and production? Should present levels of taxation be maintained with the result that about 25 per cent of the national income is allocated through government decisions? By what means could one organize the allocation and expenditure of such funds while avoiding the development of highly centralized economic management with its concomitant concentration of political power?

What are the possibilities for international utilization of the resources formally devoted to the arms race? By what means could the application of such resources be organized? It has been estimated that at the present pace of arms expenditures, about fifteen hundred billion dollars would be expended for armaments between now and 1970.[5] Sums of this size are of the order of magnitude to accomplish a reconstruction of a major portion of the surface of the earth.

What are the consequences for internal affairs in the United States and in the U.S.S.R. in the event of a slowdown, and possible termination of the arms race? In the opinion of this writer, this is a question of major strategic importance, and the answers, however tentative, would serve as a major guide for policy-making. Thereby the achievement of disarmament with appropriate inspection systems could also be made to serve desirable political ends of freer society everywhere.

[4] "1970 Without Arms Control," *op. cit.*

THE INTERNATIONAL GEOPHYSICAL YEAR AND WORLD POLITICS

By Hugh Odishaw

Author of books and articles dealing with physics, geophysics and electronics and a former college instructor in the physical sciences and humanities, Dr. Odishaw has held various executive posts concerned with scientific research in government and private industry and is presently serving as Executive Director of the U.S. National Committee to the International Geophysical Year.

For a period of eighteen months, from July 1, 1957, to December 31, 1958, the energies of many thousands of scientists, engineers, technicians, and observers of sixty-six countries have been engaged in an unprecedented study of the planet Earth and its cosmic surroundings. This endeavor, the International Geophysical Year (IGY), has succeeded in marshalling amicable international cooperation, even in a period of sharp political unrest. It has amassed a monumental body of data about the earth and the heavens; complete analysis of this data will take years of research even with the help of high-speed computers. It has proved rich in specific and provocative discoveries. By virtue of its very success it has already stimulated further international cooperation in some of the most pressing areas of geophysics. And it has ushered in the Space Age.

I

The IGY has achieved scientific results which appreciably alter our concepts of some major aspects of our planet. Excluding considerations of space, which will be touched upon later, fundamental advances have been made which affect our approach to problems of further planetary research, to problems of population and material resources, and to weather and communications. Moreover, these implications are at hand even now—on the basis of specific and isolated findings—long before the monumental body of data accumulated during the IGY has been fully analyzed.

The principal objective of the IGY was the acquisition of synoptic data in certain fields of geophysics, in which simultaneous measurements, made at many sites around the world, were needed to

obtain a planetary view of what was happening. These fields include meteorology, ionospheric physics, geomagnetism, aurora and airglow, and cosmic rays. Because particles and radiations from the sun strongly affect events and processes in the upper atmosphere, particularly during a maximum in the eleven-year sun spot cycle, studies of the sun were also necessary. Of special interest in this sense was the detection of solar flares—streams of hot gases ejected suddenly hundreds of thousands of miles from the solar disc with concurrent emission of x-radiation and ultraviolet light—in whose wake magnetic storms, ionospheric disturbances, and brilliant auroral displays frequently follow. At such times, observations and measurements were intensified appreciably, which meant that not only was the sun kept under scrutiny at all times but that a communications system was organized so that scientists everywhere could be alerted promptly.

The IGY program also included oceanographic and glaciological studies. Here, man is concerned with a better understanding of his immediate environment (the surface of the earth and the dense, lower atmosphere), and here there is at play a complex of forces suggested by the expression "heat and water budget."

If one of the principal objectives of the IGY was the acquisition of synoptic data in each of several fields of science, another was the simultaneous study of several fields in order to establish correlations among them. This aspect was particularly important in the five fields comprising the physics of the upper atmosphere and in the three fields tied to the earth's heat and water budget. To these eight fields of science were added studies in three others: seismology, gravimetry, and longitude and latitude determinations. While synoptic and interdisciplinary approaches were not pressing here, the establishment of IGY stations in regions ordinarily unfrequented by man—particularly the Antarctic and the Arctic Basin—and the conduct of expeditions to far parts of the earth afforded unique opportunities for filling in geographical gaps in past measurements.

II

Even at this time much can be said about tangible results of the IGY, some of which relate to the world of public affairs. In the course of this study of the planet Earth, which engrossed the energies of some 30,000 scientists, technicians and observers at about 4,000 stations distributed from pole to pole and at several thousand additional sites where brief studies were made, striking discoveries were made with respect to the earth itself and its lower and upper atmospheric layers.

It is often said that the great ages of exploration are dead and gone, leaving man encased within limits of known geographies. The

IGY categorically denies this view not alone with respect to the heavens but on earth itself. Its interior alone represents a vast region whose better understanding could well prove astonishing in terms of future prospects for energy and materials. But it is its surface features which are here most pertinent.

The uncovering of Antarctica represents one of the major exploratory achievements of IGY in this sense. Using seismic sounding techniques, scientists of several nations have mapped the underlying land mass in many regions. Three trans-Antarctic crossings by American scientists during the 1957-1958 Antarctic season, covering almost 5,000 miles, are destined to have an important place in Antarctic history. Early in the IGY, seismic soundings at Byrd Station, which is 5,000 feet above sea level, showed that it rested on ice 10,000 feet thick. One hundred miles eastwards, ice 14,000 feet thick was discovered. A deep trough, 3,500 feet below sea level, was found to penetrate far inland from the Weddell Sea. A host of such measurements now implies that Antarctica is a complex of island and mountain chains. The coastal regions, in particular, appear so to be, with mountain peaks lying beneath and above sea level; even portion of the interior would be under water were the ice to melt under the influence of a major climatic change.

These findings have significance to man on several levels of discourse. In themselves they constitute meaningful topographic discoveries, better filling in the picture of world geography and surface structure. The measurement of ice thickness also provides a basis for a better estimate of the world's snow and ice. This number, important in climatology, stood at 3,240,000 cubic miles but must now be revised upwards by about 40 per cent because so much more ice has been found in the Antarctic, which accounts for 90 per cent of the total. A better estimate of this quantity permits scientists to explore more sensibly the water cycle of the earth and, because the quantity is a dynamic one, its monitoring is useful as a climatological index.

Remarkable discoveries of major features of our planet have also been made in the oceans. Beneath a portion of the long-known Gulf Stream, a current flowing at a rate of eight miles per day, at a depth of 9,000 feet, opposite in direction, was discovered. In the Pacific a second amazing, beneath-surface current was found at depths between 200 and 1,000 feet, flowing opposite, to the surface equatorial current and carrying some one billion cubic feet per second. Great trenches that plunge far beneath the ocean bottoms and underwater mountain chains rivalling those on the continents have been discovered.

Again the significance of these findings exists at many levels. There is the obvious one of sheer discovery and gross exploration. There are many relating to the scientific meanings of such discoveries.

Thus, the study of ocean currents and topography relates immediately to man's seafood resources, for oceanic fertility depends upon refertilization of upper, food-bearing layers by revitalizing currents from the depths. Nor can the mineral resources of the seas be neglected. During one of the IGY oceanic expeditions a vast, mineral-rich region beneath the Pacific was discovered. Spread over millions of square miles are nodules of manganese and iron with up to one per cent of cobalt mixed with copper. The value of these ores is estimated at about $500,000 per square mile, and the economics of dredging up this thin ore-bearing layer of sludge appear promising.

Far-fetched though it may seem, such results require a reassessment of the problem of population and material resources. It is likely that we have been too pessimistic, for the earth may be richer than we have believed. If so, some new attitudes are called for: the oceans are not merely bodies of salty water where one may go fishing. They are complex, tangible aggregates which should be regarded more as land now is. Currents in the oceans fully merit consideration as rivers: the transport of the sub-equatorial current in the Pacific is 1,000 times that of the Mississippi River. "Mining" and "tilling" the oceans may well suggest an approach whose absence now inhibits the correct and imaginative utilization of their vast resources. The oceans have acres fully as much as the land.

The most publicized aspect of IGY has been the satellite program. Insofar as such publicity has overshadowed other aspects of the endeavor, it has been unfortunate because the meaning and implications of results in other areas are fully as important and require public understanding. Insofar as such publicity has been excessive, often suggesting achievements yet to be won after much painful preliminary work, it has served to diminish the national prestige and inject confusion into deliberations of future plans and activities. Insofar as it has dramatized the beginning of a new age of exploration, it may ultimately have served a useful purpose.

The interest of the IGY in satellites was an inevitable and logical extension of its concern with the upper atmosphere. In the study of the phenomena and processes characterizing the region between 30 and 300 miles above the earth, a deterrent has been the problem of direct measurements. Our concept of the earth's magnetic field in space has been based upon extrapolations of ground observations. Our knowledge of cosmic rays has rested upon observations of their particulate progeny, detected at the surface—preferably from mountain peaks—and through balloons. Our insight into the ionosphere, responsible for long-range radio communications, has come from ground stations from which radar-like pulses of radio-frequency energy have been sent as probes, whose reflections afforded data on

the heights and behavior of the several ionospheric layers. The aurora has been mapped by visual observations and more recently something of its nature determined by analysis of its electrical nature and radiations using radar and spectroscopic techniques.

Long wanted was a tool to study these phenomena *in situ*. Research sounding rockets, developed largely in this country after the war, provided a partial solution. Significant discoveries were made, and these led to a major rocket effort within the IGY. The results have been surprising. More than 300 instrumented rockets have probed the atmosphere up to 250 miles, measuring densities, pressure, temperature, and composition as functions of altitude and ferreting out particles and radiations. To cite an example: x-rays were discovered in the lowest region of the ionosphere, and it is these which now appear to be the cause of the increased electrical activity which blacks out radio communications from time to time. Moreover, their source has been established: the sun's corona.

Unique though sounding rockets are with respect to altitude variations of events, their lives are momentary and their spatial coverage almost point-like. The need for vehicles which could provide extended spatial coverage and which would have long lives, in order to ascertain both time and space variations of events, led the IGY to recommend satellite vehicles, at a time when their feasibility appeared in the offing.

Even the limited and preliminary studies of nearby space during the IGY have proved excitingly productive. The atmosphere up to 300 miles has now proved to be ten times as dense as it was thought. Something more—not yet very much—has been learned of micrometeors. Satellite temperatures in space have been measured.

Most provocative has been the discovery of a zone of radiation, starting several hundred miles above the earth and extending several earth radii out. Kidney-shaped in cross section, the zone circles the earth with probable gaps above the polar areas where the earth's magnetic poles gather in the lines of force. The radiation zone appears to consist of charged particles—electrons and protons—which can create x-rays upon impact with satellites. This discovery marks a major step in exploring space which is rich in particles, radiations, and fields that affect the planet Earth as they encroach upon space near it.

These first steps mark the beginning of a new age of exploration: the departure into space. Within a few years, space probes will have reached out to other planets. Landings on Mars and Venus with robot devices will make possible studies of their atmospheres and surfaces: Man himself, compelled perhaps by a sense of adventure and impelled by a spirit of competition, will venture into space. All this

and more will be done within the coming decade if man chooses so to devote his energies and resources, because the technical problems are not formidable. Even now engine capabilities afford us the opportunity to attempt lunar, Mars, and Venus probes.

Satellite vehicles also have practical aspects, perhaps of most value in meteorology and communications. Aside from their power to affect the science of meteorology profoundly through new data and discoveries, meteorological satellites are important for two reasons: tracking of storms, a matter of great practicality in the protection of human life and property; and speed in communications, for if weather data gathered about the world could be fed quickly into analysis centers, predictions could be considerably improved. The value of satellites for communications purposes is, of course, much broader. In suitable orbits satellites can serve as relays, with extremely broad coverage. The continued crowding of the radio-frequency spectrum and the growing demands for circuits suggest that such satellites will be developed.

Here military interests exist as well as civilian, but technically speaking the end-product of such developments is neither the one nor the other: any interest in communications or weather can utilize the products of these tools. More likely to create international concern is explicit utilization of satellites for military purposes. Two have been referred to often during recent months: reconnaissance and missile-bearing vehicles. Both are destined to receive attention from the United Nations.

IV

Leaving aside the scientific results and implications of the IGY, one of its appreciable contributions to the field of international relations has been its success in eliciting cooperation among sixty-six nations over a period of several years. How this came about affords a possibly very useful example of a method for securing international cooperation in areas of human interest besides the geophysical sciences.

The concept of the IGY did not arise suddenly or even in its full outlines. There were, first of all, two antecedents which stimulated it. In 1882-83 and again in 1932-33 two International Polar Years had been conducted. Both were largely limited to the north polar regions of the earth, and both were mostly concerned with weather, magnetic, and auroral observations. The value of the simultaneously-taken data during the First Polar Year paved the way for the Second, and the two in turn formed the background of the IGY.

The initial proposal for the IGY came about quite informally. Lloyd V. Berkner, discussing needs in geophysics with colleagues at a reception, pointed out that a third polar year afforded promise of

appreciable scientific progress. This motion was discussed by him and his colleagues at meetings of two scientific unions, the International Scientific Radio Union and then the International Union of Geodesy and Geophysics. Because the proposal was of interest to a number of unions, and its scope had been broadened to encompass the planet, these unions recommended that the International Council of Scientific Unions sponsor the coordination of the proposed venture.

The Council is essentially a non-governmental organization comprised of thirteen unions devoted to the various fields of science and of "adhering bodies," usually the academies or similar institutions in various countries. For the IGY, the Council set up a Special Committee, consisting of scientists chosen largely by the various unions. The Committee then called upon the adhering bodies to consider the proposal and to establish national committees which could serve to effect international cooperation and to plan and direct their own contributions. The criteria for the IGY, the detailed planning of activities, the agreements on data interchange — all these and other topics were discussed and resolved through a series of meetings of scientific delegates from the various national committees.

Each national committee assumed responsibility for the specific nature of its contributions, which were completely voluntary. Within the framework of the criteria established internationally, each committee determined the extent of its own work, saw to the raising of funds and the provision of logistical support, and directed the overall national effort.

The operations of the U. S. National Committee are suggestive. Established by the National Academy of Sciences, the Committee gathered together 200 experts in the eleven fields of IGY and set up a small staff. Projects and budgets were prepared. The support of the Government was solicited.

The foundation of our program was the continuing geophysical work of several public and private institutions. Thus, the networks of meteorological, geomagnetic, and ionospheric stations of the Weather Bureau, Coast and Geodetic Survey, and National Bureau of Standards afforded a firm basis for the American effort. These and similar contributions accounted for about one-third of the program. Another third represented projects and services outside the network area, and here contributions of private institutions were appreciable. The remaining third, calling for funds for new stations and their equipment and instruments, was financed by Congress through the National Science Foundation. Aside from technical contributions, the Department of Defense provided extensive logistic assistance in the Antarctic, the Arctic and the rocket and satellite programs. The stimulation of interest and support, the planning, the initiation of projects, and

overall coordinating activities were assumed by the U. S. National Committee.

From an international point of view several factors merit note. The IGY was in the hands of a non-governmental organization. It was initiated by experts who were themselves genuinely interested in the objectives of the endeavor. The problems with which they were concerned were largely devoid of political aspects: discussions therefore were generally objective, it was not difficult to arrive at agreements, and relations were amicable. Political considerations that often involve "face" were almost never present. No administration superstructure proved necessary: the officers of the Committee were temporary and unpaid; their small secretariat transient and *ad hoc*.

From a national point of view, the IGY led to a novel structure: a major effort largely directed by the scientific community. The interrelationships among institutions and individuals were inevitably many and sometimes complex. Critical to the activity were the enthusiasms, competences and personal contributions of the complex composed of the Committee, its panels and project scientists, and the Academy's staff—a complex that also embraced representatives of the principal agencies involved. The structure sketched here briefly may afford a precedent for similar efforts where the energies and talents of many individuals and many institutions are needed. The structure also served to allocate funds, for public and private agencies providing such funds relied upon the recommendations of the Committee.

V

What then, in summary, are the results and implications of the IGY to public affairs? Granted that it is premature to attempt a reasonably complete, let alone critical summation (for that must wait several years) conjecture along the following lines is reasonable.

First, a significant human venture has been realized. This venture has represented a major scientific inquiry into the nature of man's physical environment. Evidence at hand indicates that it has succeeded in its objectives: (i) the accumulation of crucial, synoptic data, (ii) the exchange of that data (a process necessarily still under way), and (iii) the discovery of the unsuspected (hoped for and anticipated, but, necessarily, not calculated upon as a justification).

Second, the IGY has achieved international cooperation among sixty-six nations. It has done this during trying political times. The cooperation had its beginnings during the planning period from 1952 to 1957; its operational period covered much of 1957 and all of 1958; data interchange, publication, and terminating activities will see the cooperation continuing for another two or three years: in full, the IGY will have seen ten years of harmonious activity.

Moreover, the IGY is generating further cooperation in those areas where the needs and promises are great. The International Council of Scientific Unions is already sponsoring several programs. In the Antarctic, whose vast expanse still remains largely unseen, the IGY type of cooperation shall continue. Plans for 1959 were made more than a year ago, and this work is under way: men from twelve nations are now continuing the studies begun during the IGY and adding new fields. Similar measures are being taken in oceanography, solar studies of certain kinds, and space research. In this last field, the ICSU Committee on Space Research held its first meeting at The Royal Society last November, organizing and planning for the future of international cooperation in space science.

Third, results at hand suggest that the IGY has opened new doors for man in relation to his environment. Some of these are purely research doors, for as new insight is gained into nature, new questions come to mind. These doors suggest that major scientific endeavors (aside from considerations of space) can be pursued in coming years. Others open up possibilities relating to material resources and techniques which will beneficently affect society—as in, for example, the intelligent exploitation of the seas.

Fourth, the physical and psychological frontiers of mankind may have been pushed farther away even on our own planet. Much remains to be done in terms of rather crude exploration before we should again feel confined—the earth's interior and the oceans, for example. That this in the narrowest sense was no secret is beside the point: countless people, including many scientists, have a new attitude toward our planet. Moreover, scientific exploration, with its concern over precious details as against broad-brush exploration, expands even more our frontiers.

Fifth, the age of space has been ushered in. The pursuit of knowledge of the universe using the tools now at hand will occupy the interests and energies of innumerable men as they reach, no longer earthbound, far into space. The drama and excitement here, if but properly construed, are incomparable, and the ultimate place of IGY in history may be as the initiator of space research. History may well regard this innovation as the most striking departure of man in this century.

Sixth, the IGY has generated certain intangibles that are of interest to man from an intellectual and spiritual point of view. These are related to arguments advanced in the preceding two paragraphs in that they have to do with the new frontiers, one allegedly on and in the earth, the other space. But the contention of this paragraph is that over and above the specifics relating to such horizons there are connotations of a more general kind.

Looking back we can see that the age of exploration following Columbus's discovery of America was charged with an excitement, stemming in large part from the adventures on strange waters and unknown lands, that was apprehended broadly and generally, entering even into the imagery of poetry. Again looking back, we can see that the Copernican astronomy achieved not alone a revolution in science but changed man's concepts of man, of his religion, and of his philosophy, and the impact of heliocentricity was felt over the course of several generations. The onset of the Space Age affords the possibility of a comparable impact.

It may be argued that the new astronomy of Copernicus had its large effect because it was an important scientific discovery while space is not a revolutionary discovery: it has been there all along and all that has happened is the availability of engines that can travel there. To this the answer is twofold. Firstly, that space has no meaning unless relizable, and its becoming tangibly within reach is emotionally comparable to the findings of Copernicus: to be at the threshold of an age which releases man from the confines of his ancestral, primordial, planetary home is no small matter. Secondly, that the advent of the Space Age has already brought striking information which begins to shed light on major events of the high atmosphere, and that there can be little question of the feasibility of successful scientific exploration, sooner or later, of interplanetary space and at least some of the planets provided man chooses to do so: the sum of these carries a high charge of excitement while the very fact that the results of man's coming space ventures are still unknown and mystery-laden to him only provides added intellectual provocation.

Provided that the complexity of modern society does not hide what is at hand, provided that the destructive forces present in our day not only do not eliminate civilization but do not, by their necessary insistence upon man's attention, mask the wonders of earth and universe, and provided that teachers and poets, scientists and philosophers sense the possibilities, there is at hand an unparalleled situation for stimulating the best in man.

THE INTERNATIONAL ATOMIC ENERGY AGENCY IN WORLD POLITICS

By Robert B. von Mehren

A practicing lawyer and partner in Debevoise, Plimpton and McLean, New York City, Mr. von Mehren served as Legal Counsel to the Preparatory Commission for the International Atomic Energy Agency in 1957 and is the author of numerous articles dealing with atomic energy problems and legal subjects.

Statements about scientific matters are not entirely sure—nothing is—but compared to politics they are so extremely sure as to be of a different order of certainty.—J. ROBERT OPPENHEIMER.

I

Part of the crisis of our times arises from the imbalance which has been created between man's understanding of nature and his understanding of man. The humane disciplines have not been able to keep pace with the acceleration of the scientific disciplines. Since the development of the scientific method, science has probed further and further into nature. However, while the natural sciences have gone forward on seven-league boots, political science and political institutions have lagged behind.

One of the most striking illustrations of this development is the story of the atom. On July 16, 1945, in the deserts of New Mexico, philosophic speculation and scientific endeavor which can be traced back some 2,500 years to ancient Greece, reached an awesome climax —the explosion of the first atomic device.[1] That may have been the baptism day of our age. For, if these troubled times are known to future historians as the Nuclear or Atomic Age, July 16, 1945 might well be selected as its name day.

The New Mexican explosion and those which followed have led to the creation of an unparalled and, perhaps, ultimate power to destroy. In little more than a decade, the fission bomb with a force

[1] For an outline of this historical background, see Robert B. von Mehren, *The Development and Use of Nuclear Power—Some Reflections on Legal Problems*, 13 The Record 350, 351-53 (1958).

equivalent to 20,000 tons of T.N.T., the bomb that ended the Pacific phase of World War II, has been outmoded by the fusion bomb with a force equivalent to 20,000,000 tons of T.N.T. The atom has already altered the technology of war and, within a few decades, it may alter the technology of peace. While solving some problems, it has led to others of magnitude and complexity. Like many other scientific developments, it has created social, political and economic problems which could not be handled without some change in existing institutions.

Science, having played Aladdin to this genie, not unnaturally has felt a deep responsibility for its behavior. The triumphs of atomic science have led many scientists to a larger concern with and participation in political affairs. To a greater extent than ever before, scientists are entering the councils of government. As their concern and involvement increases, they are becoming more and more vocal commentators on the problems of our times.

This development is undoubtedly desirable. Scientists have much to contribute to the solution of political and institutional problems. They will, however, do well to remember, as they deal with social, economic and political problems, that the world of affairs is not the world of the laboratory. As Sir Robert Watson-Watt said at the Second Pugwash Conference:

> Scientists are human and fallible. Accustomed to precision of thought in their professional activities, they are often imprecise in their use of words, and naive in their treatment of political 'principles.' The relative tractability of their science, advanced and elegant as it is, lulls them into one or the other of two unhealthy states toward humans; they may regard humans and human problems as being as unambiguous as their science; they may, on the other hand, despair of them as substantially unpredictable, and lapse into complete indifference to 'human factors.'[2]

On the other hand, the political scientist, the lawyer and the diplomat can ill afford not to seek the help and cooperation of the scientist in meeting the problems which scientific discovery and technological advance have created for mankind. All must recognize that the tides of science and technology cannot be held back and that our institutions must grow with them or be engulfed by them.

II

These introductory observations are not irrelevant to the principal subject of this paper—The International Atomic Energy Agency. The Agency was conceived of as a new international organization designed to meet some of the problems created by atomic development. Being

[2] Robert Watson-Watt, *Emotional Fall-out,* XIV, Bulletin of the Atomic Scientists 215, 216 (June 1958).

concerned with the atom, it is perhaps the international institution which most strikingly expresses the place of science in international affairs. Today a substantial part of its Secretariat is scientific or technical and, in the future, it is contemplated that an even larger part of the Secretariat will fall into those categories. And, finally, some of its most severe critics have been distinguished members of the scientific community who have complained that it is too concerned with political issues. Indeed, in the course of the general debate in its Second General Conference held this past Fall in Vienna, the delegate from New Zealand stated:

> Finally, he stressed the necessity for the Agency to have the full confidence of scientists from all countries if it wished to fulfill the hopes it had aroused. As the delegate from South Africa had pointed out, it had been clear from discussions in the lobbies at Geneva that scientists tended to regard the Agency principally as a political body which did not warrant their serious interest . . .[3]

I should like to discuss the Agency with the problem of its essential nature and this criticism in mind.

III

A considerable insight into the nature of the International Atomic Energy Agency can be gained by reviewing its background, its objectives, its structure and its environment. I propose to examine each of these matters in some detail.

A. The Background of the International Atomic Energy Agency

Shortly after the end of World War II, thoughtful persons in many countries began to consider how the terrible forces that had been released over Hiroshima might be controlled. Large efforts were made to create a body for the international control of the warlike uses of atomic energy and a number of proposals concerning the control of nuclear armaments were made in the United Nations from 1946 to 1948. These efforts were unsuccessful.

On December 8, 1953, President Eisenhower, in a speech before the General Assembly of the United Nations, shifted the emphasis from control of the warlike uses of atomic energy to the promotion of its peaceful uses. In this speech, he suggested the creation of an international agency to be concerned with the peaceful uses of atomic energy so that "the miraculous inventiveness of man shall not be dedicated to his death, but consecrated to his life."

The new agency, it was envisaged, would provide its members with information and technical assistance to develop their nuclear

[3] IAEA Document No. GC(II)/OR.21, p. 4.

technology and, in particular, with nuclear materials to be contributed jointly by "the Governments principally involved . . . from their stock piles of normal uranium and fissionable materials."[4]

President Eisenhower's proposal was greeted with enthusiasm by the General Assembly and, in 1954, it was formally endorsed by an unanimous decision of the Assembly expressing the belief "that the benefits arising from the momentous discovery of atomic energy should be placed at the service of mankind," that "the use of atomic energy to the end that it will serve only the peaceful pursuits of mankind and ameliorate their living conditions" should be energetically promoted, and that "international co-operation in developing and expanding the peaceful uses of atomic energy to assist in lifting the burdens of hunger, poverty and disease" was important and urgent.[5]

In early 1955, a group of eight nations, advanced in nuclear technology and in the production of atomic raw materials, jointly undertook the task of preparing the initial draft of the Statute of the International Atomic Energy Agency. The countries composing this working party of eight were:—Australia, Belgium, Canada, France, Portugal, Union of South Africa, United Kingdom and the United States of America. By August, they had completed a first draft of a statute which was then circulated to all members of the United Nations or its Specialized Agencies.

Although this working party of eight conducted its discussions outside the United Nations, the General Assembly continued to maintain an active interest and took several steps to encourage the establishment of the new Agency and to insure that it would have broad international support. One of the consequences of the General Assembly's interest was the expansion of the working group of eight to include four more countries:—Brazil, Czechoslovakia, India and the Union of Soviet Socialist Republics. In early 1956, this larger working party of twelve met privately in Washington to re-examine the original draft of the Statute. It agreed upon a new draft of the Statute which was substantially revised to take account of the wishes expressed by those countries which had not participated in the earlier negotiations. This new draft was submitted to an international conference which convened in New York on September 20, 1956. The conference met from September 20 to October 26 and examined in detail the draft submitted by the twelve-nation working party. On October 26, the revised Statute was unanimously approved and during the following three months it was signed by the representatives of eighty-one nations.

[4] United Nations, Official Records of the General Assembly, 8th Session, 470th Plenary Meeting.

[5] U. N. Document No. 810 (IX).

B. The Objectives of the International Atomic Energy Agency

The Statute of the International Atomic Energy Agency entered into force on July 29, 1957. It defines the basic objectives of the Agency in Article II:

> The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purposes.[6]

The initial efforts to translate these broad statutory objectives into a practical program were made by the Preparatory Commission of the Agency. This eighteen-nation group worked at United Nations Headquarters in New York during the first eight months of 1957 and in Vienna during September and October of 1957. With the establishment of the Agency and the selection of its first Board of Governors, the task of the Preparatory Commission was completed and, pursuant to the Statute of the Agency, its existence terminated.

The Report of the Preparatory Commission of the Agency states:

> In extending the peaceful uses of atomic energy, the Agency must, however, also ensure that this process remains beneficial. By the early establishment of universally recognized standards of health and safety and methods of waste disposal, it can create conditions in which the world may look forward with confidence to the ever-increasing use of atomic energy in various ways in all areas of the world. The problems to be solved and the dangers to be met are international in scope. The possibility of contamination of the air, the sea and the waterways illustrates the need for action by an international body. Measures for the protection of health and safety will therefore be a vital part of the Agency's programme from the start.
>
> Nor must the broadening of the peaceful applications of atomic energy carry the danger of increasing the military potential. The creation of a reliable system of safeguards against diversion of fissionable material to military use is therefore an equally important part of the foundation of confidence upon which alone the Agency can build an effective programme in the future. It is in this way that the Agency can contribute, not only to prosperity, but also to world peace.[7]

C. The Structure of the Agency

The International Atomic Energy Agency is composed of three bodies: the General Conference, the Board of Governors and the Secretariat. All States which are Members of the Agency are mem-

[6] Statute of the International Atomic Energy Agency, Article II (cited as "Statute").

[7] Report of the Preparatory Commission of the International Atomic Energy Agency, IAEA Document No. GC.1/1, GOV/1., pp. 4-5.

bers of the General Conference. Not more than twenty-five Members of the Agency are selected for the Board of Governors in accordance with a complicated formula designed to ensure the maintenance of a balance among the conflicting political forces of the world and a proper geographical distribution among the principal regions of the world. The Statute of the Agency makes it inevitable that, for the foreseeable future, the Board will have representation from countries of the Western Bloc, the U.S.S.R. and several of its Bloc and a number of "uncommitted" countries. It is inconceivable that a Board so composed could consider any atomic problem without the various Governors weighing its impact on the international posture and objectives of their home governments.

The Secretariat furnishes the administration and staffing of the Agency. It is headed by the Director General who, in performing his duties, is "under the authority of and subject to the control of the Board of Governors."[8] There are four Deputy Directors General, each of whom heads a department of the Agency;[9] a fifth department, Safeguards and Inspection, is headed by an official with the Dostoevskian title of Inspector General.[10] The Board of Governors, in its budget estimates submitted to the Second General Conference, proposed "that in 1959 the Secretariat should comprise 221 Professional and 278 General Service staff as compared with 176 Professional and 217 General Staff in 1958."[11]

Before leaving the structure of the Agency, the relationship of the General Conference to the Board of Governors should be considered. Under the Statute of the Agency, certain specific functions are allocated to the Board of Governors and others to the General Conference.

[8] Statute, Article VII.B.

[9] The Department of Training and Technical Information is headed by a Russian; the Department of Technical Operations by a Frenchman; the Department of Research and Isotopes by an Englishman; and the Department of Administration, Liaison and Secretariat by a Swiss.

[10] A Canadian has recently been selected for this post.

[11] IAEA Document No. GC(II)/36, p. 2. The Statute provides that the Director General is the "chief administrative officer of the Agency." Statute, Article VII.A. It also provides that he "shall be under the authority of and subject to the control of the Board." Statute, Article VII.B. Common sense would seem to require that the actual administration of the Agency should be left to him and that he and the Board should cooperate in forming policy. Yet, even in such an important administrative matter as selecting staff, it is doubtful that the Director General has the necessary freedom. In every international organization there is a principle of geographical distribution in the selection of staff. Even though Article VII.D. of the Statute of the IAEA places geographical distribution last among the criteria for selecting staff, there has been considerable pressure by Members States in behalf of their candidates.

The Board of Governors must initiate budget estimates and submit them to the General Conference for its approval. If the Conference does not approve, it must return the budget to the Board with its recommendations. The Board is then under the obligation to submit further estimates to the General Conference for its approval. This procedure must continue until the estimates of the Board are approved by the Conference.

A similar situation exists with respect to applications for membership in the Agency. A State can become a Member only after its "membership has been approved by the General Conference upon the recommendation of the Board of Governors."[12] Presumably, the proper interpretation of the Statute requires that a State seeking membership in the Agency must secure the approval of both the Board and the Conference.

The General Conference, in addition to a number of specific powers, has two general powers which may ultimately prove of great importance. It may

> . . . discuss any questions or any matters within the scope of . . . [the] Statute or relating to the powers and functions of any organ provided for in this Statute, and may make recommendations to the membership of the Agency or to the Board of Governors or to both on any such questions or matters.[13]

Moreover, the Conference can "propose matters for consideration by the Board and request from the Board reports on any matter relating to the functions of the Agency."[14]

D. The Environment of the Agency

The International Atomic Energy Agency had the misfortune of being created during the cold war. The tensions and disagreements between the East and the West have naturally had their effect upon the Agency and its work. Moreover, there has not been the demand for the Agency to act as a broker for uranium that was originally anticipated and economic atomic power now seems farther off than it did when the Agency was in the formative stages. Competing programs such as the bilateral programs of the United Kingdom, the United States and the U.S.S.R. and the multilateral arrangements of

[12] Statute, Article IV.B.

[13] Statute, Article V.D.

[14] Statute, Article V.F.2.

EURATOM have met part of the need which the Agency was created to serve. Finally, for a number of reasons, some accidental, relations between the United Nations and the Specialized Agencies, on the one hand, and the International Atomic Energy Agency, on the other, have not been as harmonious as might have been expected.

IV

Having reviewed the Agency's background, objectives, structure and environment, it is now appropriate to consider its nature and answer this question—is the Agency a scientific or a political institution? Since this question is in part a problem of definition, a brief consideration of the aim and method of science is in order.

The aim of science is to understand and explain the natural world in which we live. Its goal is to seek out new knowledge about nature; it is not concerned with the practical consequences of this knowledge. The implementation of new knowledge in terms of new techniques and new products is the responsibility of technology. Adjusting human society to the impact of scientific discoveries and technological developments is one of the functions of politics.

The principal method of science is experimentation within the controlled environment of the laboratory. It is here that science either confirms or rejects its theories. When the experimental results confirm the hypothesis, the hypothesis is established subject always, of course, to the results of future experiments. When the experiment disproves the theory, the theory is rejected for, as Thomas Henry Huxley put it, "a beautiful hypothesis [has been slain] by an ugly fact."

Considered in these terms, the objectives of the Agency are not scientific. Its objectives would seem to be dual: (1) To put the atom to work in the interests of world peace, health and prosperity and (2) to make, through control of the atom, a contribution to world peace. Such objectives are clearly political rather than scientific or technical. The Agency has neither the mandate nor the facilities to probe into the laws of nature. In a limited sense, it has certain technical objectives and it has embarked upon some technical projects. Fundamentally, however, the ends of the Agency are political. It seeks to assist the world in trying to grasp the opportunity and to control the perils which have grown out of the experiment conducted in the Stagg Field squash court in 1942.

Science, or at least modern science, has a sense of inevitability which is not present in politics. In politics anything can happen. In science, unless a wrong avenue is chosen, an insight into truth must ultimately be revealed. A part of the explanation of this difference

lies in the fact that science can control the environment in which it makes its experiments but politics cannot control the environment in which it must seek solutions.

The method of the Agency cannot be experimentation but must instead be the slower and less controllable technique of discussion and compromise. The structure of the Agency embodies the principle of checks and balances and reflects the basic power groupings of the world today. It would be indeed utopian to expect the policy decisions of the Agency to be reached without considering political issues. Furthermore, it is doubtful that, in view of the nature of many of the problems faced by the Agency, decisions could be reached on scientific or technical grounds alone.

Confirmation of the conclusion that the Agency is essentially a political institution can be found not only in the preceding discussion but also in the treatment of a variety of issues at the Second General Conference. A good example is the debate on the establishment of a laboratory for the Agency. In the budget estimates for 1959 which the Board of Governors submitted to the Second General Conference, provision was made for an appropriation of $400,000 to establish a small laboratory.[15] This led to intense debate. The debate was for the most part not about the question of what type of equipment should be purchased or the technical specifications of the laboratory. It centered instead about the political question of whether there should be any laboratory at all. The Russian delegate spoke against the laboratory:

> For example, the proposal that the Agency should establish its own laboratories, would divert effort from fundamental tasks. The time might come when the Agency could profitably devote some of its resources to constructing laboratories, but at present it had better rely on the equipment and knowledge of Member States. The Soviet Union would be glad to cooperate in a procedure by which a Member State asked for a specific piece of research to be done and the Agency contracted the work out to a country to perform it . . .[16]

[15] IAEA Document No. GC(II)/36, pp. 15 and 81. The laboratory was described as follows: "Facilities for laboratories are required by the Agency to carry out the functions described in Article III.A 2, 5 and 7 and IX.I. of the Statute (16), in particular those concerned with measurements, standardization and analysis of radioisotopes, those relating to the calibration of measuring equipment, and those functions relating to health and safety and facilities in connexion with general problems of research."

[16] IAEA Document No. GC(II)/COM.1/OR.7, p. 7. When the vote was taken in the General Conference on this item of the budget, the U.S.S.R. voted against the appropriation. In explaining its vote, the Russian delegate stated that the U.S.S.R. "attached the greatest importance to the Agency's scientific activities, and considered that the appropriation for setting up laboratories was much too low . . ." IAEA Document No. GC(II)/OR.23, p. 3.

The delegate from the United Kingdom supported the laboratory:

> It was unfortunate that the question of laboratory facilities had become a political symbol . . . If the Agency was to act simply as an exchange or intermediary through which requests, supplies and information were channelled from one country to another, it clearly would not require its own laboratory facilities; but if it was to play a more positive and constructive role in assisting Members to formulate their requests, it must itself be in a position to carry out certain kinds of research, either to assist Member States or to solve problems of common concern to all Members.[17]

Finally, the General Conference authorized the expenditure of $400,000 for a laboratory devoted to these purposes:

1. Standardization of isotopes and preparation of radioactive standards;
2. Calibration and adoption of measuring equipment;
3. Quality control of special materials for nuclear technology;
4. Measurement and analysis in connection with the Agency's safeguards and health and safety program;
5. Services for Member States which can be undertaken with the facilities needed for the above-mentioned activities.

The program of the Agency, and the progress which it has made during its first year, should be evaluated in terms of the difficulty of achieving its essentially political objectives. The scientist is often impatient with the statesman. Accustomed to the order and rationality of the laboratory, he sometimes does not recognize the difficulties inherent in finding political answers to the consequences of scientific development. The diplomat does not have the tremendous advantage of an accepted method by which to determine "truth" and he must generally concede, if he is candid, that there are arguments on every side of most political questions. This point was touched upon in the debate in the Programme, Technical and Budget Committee during the recently concluded Second General Conference. The delegate from Israel stated:

> He saw some evidence of uneasiness and impatience about the Agency's practical work, especially among scientific delegates, and thought it might be psychologically unfortunate to follow a scientific conference like that just held at Geneva with a conference to discuss the practical details of applying the achievements of science for the benefit of mankind. It was natural that the scientists should be impatient with the second type of conference, and it might be better in future to reverse the order.[18]

[17] IAEA Document No. GC(II)/COM.1/OR. 9, p. 9.

[18] IAEA Document No. GC(II)/COM.1/OR.9, p. 7.

V

The conclusion that the International Atomic Energy Agency is concerned with political objectives, that it has an essentially political structure and that it must operate in a political environment, seem to me to be basic to constructive criticism of the Agency. How, then, can the objection that the Agency is political, which ran like a leitmotif through the Second General Conference, be explained? Part of the explanation lies, of course, in forensics. Many speakers used the charge simply to state disagreement and to imply that the position with which they disagreed was illogical or irrational.

There is, however, a deeper validity to this objection. The Agency has concerned itself with certain political issues which should properly be considered in other forums. A prime example of this is the debate, in both the First and the Second General Conference, over the Red China question. At both Conferences, the Eastern Bloc, joined by a number of neutral countries, attempted to secure the admission of Red China to membership in the Agency and to prevent the seating of Nationalist China. In both cases the debate in the Agency took place after the debate and decision in the United Nations. The tactics used in Vienna by all concerned were similar to those which had been used earlier in New York.

Irrespective of the merits of this controversy, I submit that the Agency should have been spared the waste of time and ruffling of tempers created by this debate. Where a political issue is only indirectly related to the political problems with which the Agency must deal and particularly where the issue has been the subject of recent decision by the United Nations, the Members of the Agency should impose upon themselves an ordinance of self-denial. They should remember that the Agency is not the proper forum in which to debate *all* political questions. They would do well to take to heart the statement made by the President of the Second General Conference, Mr. Sudjarwo of Indonesia, during the Twentieth Plenary Meeting:

> The President observed that various speakers had complained of the intrusion of politics into the debates of the General Conference and the Agency's affairs. In view of the political situation in the world and of the international importance of atomic power, it seemed hardly practicable to exclude politics entirely; but the success of the General Conference and the Agency would be greatly helped if all concerned exercised the maximum of political toleration and did what they could to foster international good will.[19]

There is also a further element of truth in the contention that the Agency has improperly concerned itself with political issues. This element can be considered in terms of the debate in the Administra-

[19] IAEA Document No. GC(II)/OR.20, p. 2.

tive and Legal Committee, during the Second General Conference, on the issue of the Agency's relations with EURATOM. EURATOM had not been invited to send an observer to the First General Conference; it was invited to send one to the Second General Conference. This resulted in a lengthy debate on the question whether EURATOM was devoted solely to the peaceful uses of the atom. The Eastern Bloc contended that it was not and, consequently, that it could not properly be invited under the Statute of the Agency to attend the Conference. The EURATOM countries, particularly France and Belgium, defended the invitation and asserted that EURATOM had "the object of promoting the peaceful uses of atomic energy."[20]

The Statute provides that "The Board of Governors, with the approval of the General Conference, is authorized to enter into an agreement . . . establishing an appropriate relationship between the Agency . . . and any . . . organizations the work of which is related to that of the Agency."[21] The issue, therefore, is basically what is the proper interpretation of the Statute. This would not seem to be a difficult question and the invitation to EURATOM, even if it were conceded that EURATOM had some remote connection with the military use of the atom, would appear to be proper. Certainly the work of EURATOM is related to that of the Agency and the Agency may be able to learn a good deal about a variety of subjects from the EURATOM experience with its one million kilowatt program which is scheduled for completion in 1963.

The EURATOM debate should never have occurred. An authoritative interpretation of the Statute should have been sought and the matter should have ended there. Certainly, Members should forbear from debating political issues when their position rests upon flimsy legal grounds and when they seek to block avenues which may substantially increase the technical knowledge of the Agency.

VI

The atmosphere of the Second General Conference of the Agency was gloomy by contrast with that of the First General Conference. Perhaps too much had been expected; perhaps too little had been done. On balance, however, the first year of the Agency's life could

[20] IAEA Document No. GC(II)/COM.2/OR.10, p. 5.

[21] Statute, Article XVI.A. In the debate in the Administrative and Legal Committee, Mr. Samokish of the U.S.S.R. stated: ". . . by virtue of paragraph A of Article XVI of the Statute, the Agency should establish relations with inter-governmental organizations which were concerned exclusively with the peaceful uses of atomic energy." IAEA Document No. GC(II)/COM 2/OR.10, p. 4. This interpretation of the Statute is certainly not required by the principles of construction used in Anglo-American jurisprudence.

not have been expected to produce much that was startling. The first year had to be spent in building for the future.

The most significant development of the Agency's first year seems to have taken place during the Second General Conference. Prior to the Conference, no request for the supply of fissionable or source materials had been made to the Agency. In the midst of the Conference, the delegate from Japan announced that on September 23, 1958 "his Government had made a formal request to the Agency for its assistance in obtaining about three tons of natural uranium of reactor grade in the form of metal ingots, required for its first national research reactor."[22] The Japanese delegate also stated that his Government had informed the United States, with which it has a bilateral agreement, "that it intended to request the Agency to apply its safeguard provisions with respect to the agreement concluded with the United States, as soon as the Agency was in a position to perform that service."[23]

The initiative taken by the Japanese presents the Agency with a significant opportunity to move forward towards its basic objectives—putting the atom to work in the interests of world peace, health and prosperity and making a contribution to world peace through control of the atom. This initiative will breathe life into the Division of Safeguards and force a start, although perhaps politically distasteful to some Members of the Agency, on a safeguards program. It is, of course, only a modest beginning and many problems lie ahead—such as the question of the price the Agency will charge and the substance and form of the safeguard provisions, to name only two. Much will depend on the support of the Agency's efforts by its principal Members. If they desire to have the Agency take advantage of this opportunity and provide it with the support—both financially and politically—which it will need,[24] a long stride forward may be taken.

The unique function which the International Atomic Energy Agency can perform in the service of mankind is to establish a safeguard system which might eventually find a very wide, if not universal, application. The Agency is probably in a better position to do this than any other organization or entity. The Japanese request has provided the occasion for starting work on this difficult, but most important, task.

[22] IAEA Document No. GC(II)/OR.17, pp. 2-3.

[23] *Id.* at 3.

[24] In other places I have discussed some of the difficulties the Agency faces and, particularly, the problems created for it by competition from bilateral programs and regional programs. See Robert B. von Mehren, *The International Atomic Energy Agency—Challenge and Opportunity,* 13 The Record 56, 63-65 (1958); Article on agreements for cooperation to appear in a work on law and administration soon to be published by Pergamon Press, Ltd., in its Progress in Nuclear Energy series.

THE MILITARY CONTROL OF OUTER SPACE

By Albert C. Stillson

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Science is giving man the physical and technological powers of Superman in a Buck Rogers' suit. Man is attaining an awesome ability to control, exploit, transform and destroy his earthly environment. The time is fast approaching when he will be able to move mountains, wipe out most diseases, circle the earth in a flash and build machines to do a large part of his mental as well as his physical labor. He is now rippling the fringe of outer space. Soon he will have created a whole new age—the Space Age.

There is little to indicate, however, that science will give man either super-wisdom or super-morality with which he can alter radically his values, beliefs, institutions and political behavior. A revolution greater than any scientific and technological revolution ever known would take place if men and nations were to utilize outer space for purposes different from those for which they have utilized the earth.

In spite of hopes and dreams for peaceful and regulated activities in outer space, we can expect that outer space will become another arena of competition among sovereign states and between the East and the West, in particular. Outer space competition will affect and someday it may tip the East-West balance of power. Likewise, the East-West balance of power must determine the feasibility of foreign policy goals, including goals such as the peaceful use and regulation of outer space.

In the Space Age, as at the present time, East-West competition will require that United States national security policy rely heavily on military power. While the detailed characteristics of outer space military policy will depend greatly upon future scientific and technological developments, some broad strategic concepts will be needed to give form and direction to that progress. Too often in the past policy makers and military strategists have abdicated one of their

major responsibilities: to attempt the very difficult task of directing and greeting the development of new weapons and new weapons systems with foresight and insight.

One concept which has been basic to seapower and airpower doctrine, each of which deals with a kind of spatial military power, is that of control. The concept of control may also be very helpful in analyzing outer space military power, which can be regarded as the purest form of spatial military power. The task of this article is to take a first step toward analyzing the concept of the military control of outer space and to suggest some ways in which such an analysis may give helpful perspectives on national security policy in the outer space age.

The Concept of Military Control of Outer Space

Control of the sea and the air can be defined as the ability to use the sea and the air for national objectives and to prevent an enemy from using the sea and the air to attain his national objectives. What these objectives are and against whom they are to be supported determine how much, what kinds of, and in what ways control is to be sought.

In the abstract, control of the sea and control of the air, like the concept of perfect competition in economic theory, are analytical tools designed to render meaning to reality rather than to describe reality. The concept of control in seapower and airpower doctrine gives policy makers and strategists a standard against which they can estimate their military objectives and capabilities in relation to those of their enemies. That these objectives and capabilities do not permit perfect control does not mean that the control which is possible is not militarily advantageous or even vital.

For centuries, Great Britain came closer than any other nation to exercising perfect control of the sea. In employing wisely the strategic doctrine of control, Great Britain built and maintained a war fleet to insure the safety of her communications and trade routes, to support her national objectives, and to prevent her enemies from using the sea to their own advantage. Although the British war fleet, operating from a world-wide network of naval bases, could take the measure of the naval forces of England's enemies, the control of the sea which the British war fleet won by decisive naval battles was not only imperfect but inadequate when decisive naval engagements did take place. Enemy commerce raiders could still use the seas, and enemy merchantmen could still make successful voyages.

Britain found it necessary, therefore, to establish control points, such as Gibraltar, which dominated the narrow exits and entrances separating and uniting the seas. Even these control points did not

prevent Britain's enemies from using the sea advantageously. As a result, "close-in" blockades of enemy harbors and coastlines and blockades of sectors of the sea by naval squadrons were also employed by Great Britain to further seal off her enemies from the sea. Blockades, too, were a less than perfect means for controlling the sea. The vastness of the sea, the vagaries of the weather and the cleverness of enemies weakened and sometimes made ineffective the most carefully worked out blockade plans.

In more recent years, science and technology added new dimensions to sea warfare. England was forced to devote a large portion of her naval efforts to the task of insuring her own use of the sea. She herself had to fight against strangulation by blockades of new types. She had to fight against the severing of her communications and trade routes by enemy submarines and aircraft.

As we know, however, Great Britain derived great political and military benefits from striving for control of the sea. She found that control of the sea was a viable strategic doctrine because the benefits conferred by less than complete control of the sea were greater than the costs of trying to achieve complete control and because an advantageous control of the sea was, in the main, technologically feasible. In spite of recent scientific and technological developments control of the sea still seems to be a viable military concept, although it may not remain so beyond the immediate future.

Military control of outer space, on the other hand, may not be a viable strategic concept, for outer space military power will continue and will accentuate problems of control with which airpower doctrine has had to contend. These problems stem from scientific and technological revolutions in weapons and weapons systems.

In World War II, the arena in which airpower played its part was infinitely smaller than the arena in which outer space military power will be exercised. Yet when the Allied air forces had general control of the air, their enemies, by obtaining temporary use of limited airspaces, could still carry out successful operations. With the advent of weapons of mass destruction, a temporary use of limited airspaces by relatively few planes is sufficient for the mounting of not only successful but devastating attacks. Ever faster and more mobile delivery systems will make it increasingly difficult to prevent an enemy from launching major and repeated offensives. In the Space Age, just a few missiles and rocket ships, launched from dispersed bases on the earth and in outer space and equipped with thermonuclear weapons, could easily constitute major and perhaps decisive military offensives.

Unless or until man lives in outer space, a life independent of the earth, the use of outer space will have meaning only in relation

to life on earth. For this reason, military control of outer space will be significant only to the extent that it affects the military policies and capabilities of the nations on the earth. The Soviet Union might develop the ability to use exclusively large sectors of outer space. But if she could not use this control to prevent the Western powers from destroying her earth-bound power centers, the East-West balance of military power would not be basically affected.

Relation of Earthbound to Space Military Control

What, then, are the chances that use of outer space would significantly affect military relationships on earth? One possibility is that pre-empting outer space "property" such as the moon and putting into outer space man-made bases and platforms may lead to the creation of outer space control points similar to those earthly ones owned by Great Britain and used by the British navy to control the sea.

It can be argued that if the United States achieved control over the moon and built a military base on it, a very effective deterrent to Communist aggression would result. While a major Communist attack might wipe out most or all of the West's earth-bound retaliatory power within hours, Soviet missiles and space ships would require about four and three-quarter days to travel from the earth to the moon. This time lag would give a moon base ample opportunity to mount a retaliatory attack against Communist power centers on earth. A moon base might, therefore, cancel out the advantages to be gained by initiating total war.

The value of a moon base as an outer space control point would depend partly on whether the threat of earth-bound retaliation or the threat of an earth-launched attack on the moon would deter a military power which dominates the moon from undertaking major aggression from either the earth or the moon. The answer to this question cannot be known at present, but simply by raising the issue it can be seen that there can be no sharp dividing line between earth-bound and outer space military power and control.

Another reason for doubting whether a moon base would be able to exercise any appreciable control over the actions of an enemy is that outer space "overseas" bases, unlike naval bases and air bases, probably will be established with relative ease and with relatively few restrictions as to their number. A moon base might readily be neutralized or put out of commission by a man-made space station or platform so located as to dominate the moon. It would appear, for the same reasons, that any space control point imaginable, either artificial or natural, could be neutralized or destroyed by either space-launched or earth-launched weapons.

As far as we can now foresee, the concept of control in outer space military doctrine is not invalid because outer space military powers cannot use or even dominate sectors of outer space. The invalidity of the concept arises from the fact that military adversaries cannot be prevented from using outer space effectively and that they can, with relative ease, neutralize, by-pass, or destroy outer space control points established against them.

National Security Policy in the Space Age

The probability that there can be no militarily decisive control of outer space and no viable concept of control in outer space military doctrine is significant in many ways for national security policy in the Space Age.

The inapplicability of such a concept in the Space Age indicates that, at a time when policy makers and military strategists desperately need a doctrinal framework on which to hang and give a degree of order and meaning to new and perplexing scientific and technological developments, they will find it difficult to obtain guidance from existing strategic doctrines. As a result, policy makers and military strategists will have to soar into outer space instinctively—"by the seat of their pants," so to speak. This does not mean that they will always have to rely on posterior guidance systems or that they will have to soar aimlessly.

A hazy but basic guideline for outer space military policy is that outer space weapons and military instruments will undoubtedly be militarily advantageous and play an important if not major role in the East-West military struggle. The improbability that outer space military power, in itself, will determine the East-West balance of military power does not lead one to the conclusion that the United States need not pursue an active and imaginative outer space military program. Reconnaissance and communications satellites, space stations, and space bases for missiles and rocket ships may join with both earth-based outer space weapons and earth-bound weapons in such ways that the power of defensive as well as offensive weapons systems will be greatly augmented. A "mix" of outer space and earth-bound weapons systems may be incomparably superior to earth-bound weapons systems.

What the proper "mix" of outer space and earth-bound weapons should be at any given time in the Space Age will be hard to determine. We can be fairly certain that no single weapon or weapon system would give a clear military advantage over an enemy, although each weapon and weapon system would have definite and constantly fluctuating military advantages. This situation, plus both the lack of a

workable concept of control in Space Age military doctrine and ever changing weapons technology, will make for an uncertain and unstable balance of military power between the East and the West. Such instability could easily lead to miscalculation of military capabilities and it might be conducive to reckless foreign and military policies.

At the present time, the so-called "balance of terror" helps to work against recklessness in foreign and military policy. But a balance of terror, to be meaningful, requires a concrete approximation of the risks which aggression and war would entail. It is exactly this approximation which the volatile nature of Space Age weapons and weapons systems may prevent. A general feeling of terror in the Space Age would not deter war as effectively as fears of identifiable and measureable war dangers.

The dangers inherent in the instability of the balance of East-West military power in the Space Age will be joined by another danger which also springs from lack of an appropriate concept of control in outer space military doctrine. This danger is that fighting in outer space would automatically involve earth-bound military power, and that fighting on earth would automatically involve outer space military power. Because neither outer space nor earth-bound military power gives promise of being decisive in itself, the two, being "mixed" for maximum military security, could not easily be "unmixed" in case of war. For this reason, it does not seem that in envisaging and planning for Space Age military security we should place emphasis or importance on the likelihood of being able to wage total war in outer space alone. A total war between the East and the West which could be waged entirely in outer space without involving directly life on earth certainly would be more desirable than a total war which ravaged both outer space and the earth. Outer space fighting, however, could not settle decisively an East-West war unless the victor won military control of the earth. This will be precluded, apparently, by the nature of Space Age weapons and weapons systems.

Skirmishes in outer space alone may, on the other hand, be possible. It is not unreasonable to assume that outer space military competition may result in outer space fighting. A situation which comes immediately to mind is the shooting down of an adversary's reconnaissance or "seeing-eye" satellite. Depending on the level of political tension and the heat of outer space military rivalry, such an act might result in retaliation in kind or on a broader front. We have some grounds for hoping that outer space skirmishes will not expand into total war, because military control of outer space will not exert a decisive military influence on the international power struggle. But outer space fighting that involves or jeopardizes the strength of the "mixes" of outer space and earth-bound weapons could easily develop

into total war. The same can be said of "brushfire" wars or skirmishes that start on the earth.

With the instability of the Space Age balance of military power, the volatile nature of weapons and weapons systems is constantly being altered and refined by science and technology; and the great variety of weapons which will operate through, in, or from outer space, policy makers and military strategists will be hard put to place the proper emphasis on the military instruments which will best support national objectives. Nonetheless, at least two guiding principles for the allocation of Space Age national defense efforts appear to have merit.

The first is that Space Age defense policy should not attempt to use and at the same time to deny to an adversary large sectors of outer space. Control of outer space, in itself, is not likely to be of primarily military significance, and attempting to colonize outer space will dissipate efforts that could be better invested in decisive military power. Control of sectors of outer space may be considered important for psychological, ideological, or scientific reasons. The over-all political considerations of outer space national security policy may dictate a policy of control, whereas narrower considerations of military strength may dictate otherwise. The very great anticipated costs of Space Age security policy demand that careful attention be paid to national means and national ends.

The second guiding principle is that a large portion of national security efforts should be devoted to military defense of strategic areas on earth and to civil defense. The power, speed, sophistication and mobility of outer space weapons and weapons systems will increase hundreds if not thousands of times the capabilities of military offense. A fleet of rocket ships, for example, attacking from hidden earth bases or from dispersed and far flung space bases could wreak havoc on earthly power centers. For this reason, a requirement for rugged civil and passive defenses seems to be indicated. Defense of earthly power centers, by relying on offensive power, would face the immense task of destroying hidden, dispersed, mobile, and numerous enemy bases and power centers. Defense by offensive power would run the grave risk of awarding an enemy the first and perhaps only blow.

Defenses against missiles and all types of space vehicles will be costly. Such defenses constructed in outer space would probably be ineffective, because of the improbability of attaining a militarily meaningful control of outer space. The remaining and apparently the only successful defense of earthly power centers would be a "close-in" defense. To be effective, even a "close-in" defense would undoubtedly have to stretch into wide sectors of outer space. But insofar as possible, it should be a closely-knit defense grid. Any other

type of defense not only promises to be ineffective, but also would result in dissipation of security efforts. All this does not mean that major efforts should not be put into military offense. It does mean that in the Space Age we cannot afford to neglect, as we have been wont to do in the past and the present, what are now called air, civil, and passive defenses.

What has been said here must be regarded as purely suggestive. We must be imaginative enough to begin planning for national security policy in the Space Age, and we must be flexible enough to alter those plans when necessary.

We cannot know with certainty that a thorough-going military control of outer space and therefore a viable concept of control in outer space military doctrine, will not be possible. The important thing is not to make "right" or "wrong" speculations about Space Age military power and doctrine. The important thing is to start thinking about these matters.

One who does this, no matter what particular set of hypotheses he derives, must conclude inescapably that political, military, and scientific instability in the Space Age will be very great. Living with and developing wise national security policies within the framework of this instability promises to be an immensely difficult task. The task will be made possible only if we have the courage to recognize it for what it is—a dirty but necessary business.

SCIENTIFIC PROGRESS AND THE GOVERNMENT OF OUTER SPACE

By Christopher Wright

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Science and technology have now made outer space an arena for human endeavor. The aim of government in this new territory appears destined to depart significantly from two traditional emphases; one on security from serious disputes and the other on the predictability of future relationships among nations. Strong expressions of these interests have appeared in this new context but they promise to be overshadowed as primary categories of thought by an emphasis upon scientific progress as such. However, abandonment of the traditional emphases need not imply that nations will in fact become less secure and their international relations less predictable.

In the nine days of United Nations debate on resolutions concerning outer space in November, 1958, the emphasis upon security received priority in the remarks of many delegates including the United States and Soviet representatives. Whether or not a given argument also concerned prevention of military uses of bomb stockpiles or land bases as well as use of outer space, the issue was cast in terms of potential military versus exclusively peaceful uses of outer space. Echoing President Eisenhower's urging that outer space be used solely for peaceful purposes, Ambassador Lodge said that steps must be taken to find methods which would insure that outer space be used exclusively for peaceful purposes,[1] and Mr. Zorin of the Soviet Union said that everyone was in agreement on the need to use cosmic space for purely peaceful purposes.[2] Many delegates expressed similar views varying only in the relative urgency of establishing machinery to insure that only peaceful uses were advanced. Significantly, no one urged that all outer space activities be delayed until this security could be achieved.

As one alternative to security, some delegates placed high priority on establishing predictability by international agreements. These would govern rights and responsibilities related to the use of outer

[1] Debate in the United Nations Political Committee, November 13, 1958.

[2] *ibid.*, November 18, 1958.

space before national claims could be asserted. The Chilean and Belgian delegates suggested that the most important questions were: "to whom does outer space belong?" and "can outer space be used without restriction?"[3] The Brazilian delegate suggested that the United Nations now had an opportunity to construct a new set of regulations that would terminate the present *de facto* situation.[4] The delegate from El Salvador hoped that the principle would be laid down that outer space and celestial bodies could not be appropriated by any nation.[5] Similar views reflecting the need to restrict nationalistic expansion into outer space were emphasized in varying degrees ranging from one of utmost urgency to the suggestion by the United States that while it was important to settle legal rules of outer space, it was first necessary to gain more knowledge of the nature of outer space.[6]

While some statesmen thus saw this new challenge in terms of the security of nations or in the formulation of a legal framework which would control exploitation of outer space and thus increase predictability, other spokesmen in the United Nations appeared to suggest an alternative to both of these: progressive exploitation of outer space regardless of the resulting threat to the security or predictability of human affairs as traditionally conceived. Among them the Australian delegate was perhaps the most articulate proponent of the view that the need for an international approach to the problems of the peaceful use of outer space extended much further than its bearings on problems of security and that a new problem was how man's venture into space was to be organized.[7] This view, with its sense of an urgent need to carry on with scientific progress, infused the whole United Nations debate. Along with a concern for security and predictability, it was reflected in the United Nations resolution passed by the Political Committee of the General Assembly on November 24, 1958. This resolution not only stated the aim of using outer space for peaceful purposes only[8] and called for a study of legal problems,[9] but also expressed the desire "to promote energetically the fullest exploration and exploitation of outer space for the benefit of mankind."[10] It requested an Ad Hoc Committee to report on ways and means for

[3] *ibid.*, November 12, 1958.

[4] *ibid.*, November 17, 1958.

[5] *ibid.*, November 20, 1958.

[6] *ibid.*, November 15, 1958.

[7] *ibid.*, November 17, 1958.

[8] Paragraph 1 of the preamble to the resolution passed by the United Nations Political Committee on November 24, 1958.

[9] Operative paragraph (d) of the resolution.

[10] Paragraph 4 of the preamble to the resolution.

doing this. If scientific progress is incompatible with an equal emphasis upon either security or predictability, a glance at the present state of proposals concerning outer space suggests that scientific progress is receiving priority. This is due in part to some unusual scientific and technical characteristics of astronautics. The Ad Hoc Committee and other responsible groups are now concerned with formulating proposals for improving the existing rather unarticulated government of outer space. Much depends upon which of the three categories of thought receives most emphasis.

I

The variety of possible activities in outer space includes new opportunities for transportation, observation and communications. These can be applied to desirable and undesirable purposes ranging from interplanetary travel to intercontinental ballistic missiles, from pure scientific observation to reconnaissance of enemy territory and from worldwide navigational aids and communications systems to jamming of regular communications channels.[11] The government of outer space as it now exists has aspects which affect the security, predictability and progress of human activities in these areas. This pattern of government includes international exchange of information about orbits, instrument signal codes, the findings of instruments designed to measure certain phenomena in outer space and other exchange and cooperative procedures developed for the International Geophysical Year. There is also the pattern of launching satellites, which will pass over or near territories of many nations, without requesting permission from these nations.

From the point of view of operational effectiveness, the government of outer space now includes at least two well-organized systems, one in the United States and the other in the Soviet Union, both of which coordinate the activities of many industries and surround rocket developments and launchings with considerable secrecy. These governmental arrangements are not entirely military. The United States in particular has organized a number of rocket projects having both military and peaceful aspects. In cooperation with its allies an effort has been made to avoid or at least minimize disputes which might nullify the operational effectiveness of space vehicles or otherwise limit further advances in astronautics.

The pattern of government for dealing with unexpected contingencies is less well worked out, but probably includes "liability without fault" in that a country might offer compensation in the event a rocket or satellite caused damage, much as the United States

[11] For a helpful systematic outline suggestive of many opportunities and problems associated with the use of space, see "Space Policy Outline," by Lewis C. Bohn, 5 *St. Louis University Law Journal* 1, p. 85.

gave money to Japan after some Japanese fishermen were exposed to radioactive fallout from a Pacific nuclear bomb test. At present there exists little effective machinery for eliminating disputes about the use of jamming of communications should they arise. In recognition of this fact, some satellites designed in the United States include provisions for the storing of information to be divulged only when the satellite is within "friendly" territory. We must also be prepared for the possibility that a rocket might damage a satellite or another rocket; as long as there are no human beings aboard, it is doubtful that any protest would be acknowledged regardless of where in outer space the incident took place. From a legal point of view there are many gaps in this pattern of government. These are more disturbing to persons trained to anticipate human conflict and predict the outcome than to the scientists who are primarily interested in governmental arrangements that will facilitate their immediate scientific explorations.

II

There is room for further development of government to promote security and predictability. Criticism of present patterns of government underlay the United Nations debate on the use of outer space and was stimulated in part by a belief that he who controls outer space controls the world. Any resultant threat to security and predictability may be an outgrowth of existing military or legal conditions which can in theory be corrected, but it may also be for a quite different reason having little to do with conventional military or legal positions. Whatever private group, nation, or group of nations is thought to control outer space, may in fact be accepted as the world leader because it will by definition be the most progressive. It is not impossible that scientific and technological leadership will acquire charismatic authority superseding the rational-legal authority of governments, emphasizing security and predictability. Any government of outer space adequate to settle and avoid major disputes must incorporate and emphasize whichever authority-values are most significant in this situation.

A number of individuals and groups besides the United Nations have concerned themselves with the development of one or another aspect of government for outer space. Among many official and unofficial groups in which American participants are active, there are the International Civilian Aeronautics Organization, the Committee on Space and Astronautics of the United States Senate, the Committee on Science and Astronautics of the House of Representatives, (formerly the Select Committee on Astronautics and Space Exploration), the Advanced Research Projects Agency of the Department of Defense, the National Aeronautics and Space Administration, the

American Bar Association Committee on Law of Outer Space, the Space Science Board of the National Academy of Sciences-National Research Council, the Committee on Space Research (COSPAR) of the International Council of Scientific Unions, the International Law Association and the International Astronautical Federation. It is possible to divide the interests and ideas of these groups according to whether the major emphasis is upon security, predictability or scientific progress.

Sir Leslie Munro's comment that outer space can be used for purposes of war or peace not only states an obvious fact but puts this fact into a framework based upon the separate categories of peaceful and military uses. This dichotomy was recognized by Ambassador Lodge in the United Nations debate when he stated that "candor compels us to admit that agreement on the disarmament aspects of outer space lies in the future." It is also recognized by a professor of law who has argued for concentration on the real and obvious problems, the most urgent of which is the design of "workable international control over ICBM's as nuclear-weapons carriers."[12] In this way the problem of intercontinental ballistic missiles and their use for surprise attack has been separated from issues connected with all other uses of rockets in outer space and has been the topic of separate international technical discussion at Geneva since last November.

The other side of this dichotomy is the recognition of peaceful uses as something apart from military uses. The United States once proposed in the United Nations Disarmament Commission that all rockets be inspected to make sure that they were for peaceful uses and the Soviet Union has suggested prohibiting military experiments in outer space. Although the United Nations resolution avoided all direct references to controlling military uses, the Japanese delegate to the United Nations General Assembly, Mr. Matzudaira, urged the Assembly to avoid the possibility of "a new form of veto power" which might "paralyze" efforts to limit cosmic space to peaceful uses.[13]

Proposals and comments such as these reflect the concern for enhancing the security of society by recognizing military potentialities for what they are. They are usually phrased in terms of restricting military experiments and uses, although Ambassador Lodge's acknowledgement that this may be subject to delay, suggests a further recognition that the development of military potentialities may at least contribute to the security of the United States. The frame of reference continues to be the dichotomy between military and peaceful uses with

[12] Nicholas Katzenbach, "Law and Lawyers in Space," *Bulletin of Atomic Scientists*, Vol. XIV, No. 6, p. 224.

[13] Debate in the United Nations Political Committee, November 20, 1958, as reported in *The New York Times*, November 21, 1958.

the relevance of limitations on the former to the security of mankind attracting most attention. This approach is therefore also characterized by the same emphasis upon restrictiveness and negation which is reflected in the effort to ban nuclear bomb testing.

The concern for predictability is a dimension different from that of concern for security. Anticipation of consequences, with sufficient clarity to help avoid disputes, may well offer some kind of security, but it need not necessarily do so. Wars have been fought with the help of rules, regulations and unwritten conventions covering behavior in a variety of circumstances. Nevertheless, the rule of law is man's best tool for instituting predictability and a number of proposals for governing outer space emphasize the primary importance of recognizing, establishing and enforcing explicit rules which may even promote insecurity but will at least offer predictability.

These proposals include general ones concerning the limits of territorial sovereignty, the rules of navigation in space, the rules for telecommunications and the law of discovery for celestial bodies.[14] Analogies have been drawn to the legal status of the high seas and weight has been given to the fact that there were no objections by nations to the orbiting of satellites passing over almost the whole of the inhabited world. On the basis of legal considerations the United States has even been urged to plan rocket experiments suitable for establishing legal claims to the moon.[15]

These problems have been the concern of special committees of the International Astronautical Federation, the American Bar Association, the New York State Bar Association, and the International Law Association as well as of many writers on legal subjects.[16] And already, within the United States government the concern for predictability has been met in part by new legislation which has to some extent redefined the relationships between governmental bodies acting in the fields of aviation, rocketry and space exploration.

In this approach to outer space problems not all proposals place equal emphasis on predictability by means of comprehensive legal declarations and agreements. At one extreme, there have been resolutions like that sent to the Secretary General of the United Nations by the International Astronautical Federation, which called for a new international convention to govern legal problems inherent in space exploration and activities. The Secretary General of the United Nations has expressed the hope that the General Assembly would "find the way

[14] See Michael Aaronson, "Space Law," *International Relations*, Vol. I, No. 9, p. 416 for an analysis of the proposals related to these factors.

[15] Robert Bendiner, "Who Owns Outer Space?" *Reporter*, June 12, 1958, p. 19.

[16] For a selective bibliography listing 256 writings on space law, see John C. Hogan, "A Guide to the Study of Space Law," 5 *St. Louis University Law Journal* 1, p. 76. Also, "Checklist of Materials on Law and Outer Space," 13 *The Record* 6, June, 1958, p. 396, 64 items.

to an agreement on a basic rule that outer space, and the celestial bodies therein, are not considered as capable of appropriation by any state."[17] The legal counsel to the United Nations and others have urged a "go slow" attitude which nevertheless recognizes the paramount importance of establishing government of outer space based on clear rules of law once this first exploratory phase has been passed. The efficacy of general rules based upon premature agreements or vacuous extensions of international law have been doubted by some who suggest that when the time is right, agreements among nations will suffice to solve any problems or uncertainties.[18] At the other extreme, the President of IAF favors agreements now to handle imminent problems of telementry and liability for physical damage. A nation's privacy, radio communications and weather may be tampered with by high altitude activities.

This emphasis upon the use of the rule of law for enhancing predictability is for all practical purposes based upon the nation-states as primary legal units with domestic and international law built from them. The various statements in the United Nations debate on outer space can be contrasted with either the emphasis upon international arrangements to avoid national rivalries or their willingness to forego agreements now and accept the possibility that technical advances may permit individual nations to establish control over some use or aspect of outer space. The Iranian delegate and others shared the opinion that, since the benefit of outer space should be enjoyed by all, it should be regarded as belonging in its entirety to the whole world and not subject to various national sovereignties.[19] While the United Nations resolution requested the Ad Hoc Committee to report on some uses which would benefit states "irrespective of the state of their economic or social development" the Italian delegate and others recognized that the financial burden has hitherto prevented many technologically advanced countries from launching artificial satellites.[20] The United States, on the other hand, has the launching capacity but wishes to have possible legal arrangements studied while more knowledge is gained concerning the nature of outer space.[21]

Most views expressed in the United Nations as well as in other proposals for governing outer space reflect in varying proportions an interest in both security and predictability as well as in what we have called scientific progress. Progress, as referred to here, offers a third dimension which can be emphasized in preference to security or predictability. Certain aspects of the science and technology of astro-

[17] *New York Times*. November 16, 1958, p. E 3.

[18] Katzenbach, *op. cit.*, p. 222.

[19] Debate in the United Nations Political Committee, November 18, 1958.

[20] *ibid.*, November 12, 1958.

[21] *ibid.*, November 13, 1958.

nautical exploration of outer space invite this emphasis and suggest that progress towards the fullest, most consistent pattern of exploitation of outer space may become an aim which will cut across the dichotomy between military and peaceful activities or national and international activities.

The United Nations resolution included the desire "to promote energetically the fullest exploration and exploitation of outer space for the benefit of mankind." The compatibility of this with peaceful development and the preservation and even promotion of international cooperation and legal order is clearly implied by the resolution. But whether or not this is the case depends in part upon space technology and the justification for peaceful development and international cooperation is mentioned in such a way as to suggest their contribution to this progress rather than vice versa. The emphasis upon government designed to advance space technology rather than to enhance security or predictability is even more apparent in the establishment and program of the "non-governmental" International Committee on Space Research (COSPAR). The proposal by the staff of the House Select Committee on Astronautics and Space Exploration also reflect this in that primary emphasis was given to the utilization of scientific resources in the world at large, for our effort in all the space sciences and that the IGY mode of operations is "too beneficial to the scientists of the world . . . to be allowed to expire at the end of 1958."[22] The United Nations resolution also specifically mentions the desirability of continuing "the outer space research now being carried on within the framework of the International Geophysical Year," and this language was borrowed from a Soviet draft resolution.

In much the same vein, one of the originators of the International Geophysical Year, Lloyd Berkner, has suggested that "certainly, international regulation and control of satellite launchings and instrumentation will be needed. Such regulation must encourage scientific employment within a framework of optimum effectiveness and cooperation, international scientific usage of the data, limitation of the nuisance potentials and international prediction or orbits."[23] The emphasis here is upon exploration and exploitation with international arrangements suggested as a means to this end.

Quite possibly the emphasis upon scientific progress rather than security or predictability is based upon the belief that there is no inherent incompatibility between these three goals. In fact, various

[22] Staff Report of the Select Committee on Astronautics and Space Exploration, October 15, 1958, p. 14.

[23] Lloyd V. Berkner, "International Regulation and Control—the Dilemma of Civilization," remarks at the opening of the Symposium on "The Challenge of Nuclear Power and Outer Space to Political Control," Duke University, Durham, North Carolina, May 14, 1958.

aspects of astronautics appear to magnify this incompatibility. As these categories cease to be useful in this new context, the traditional means to security and predictability—i.e., by military defense and international rules of behavior—will to this extent no longer be available.

III

We have indicated how various ideas and proposals dealing with government of outer space can be grouped according to the emphasis they place upon security, predictability or scientific progress. The phrasing of a proposal in terms of one emphasis may actually conceal the fact that the net effect of the proposal can be better understood in a different framework. Government depends in part upon the manipulation of men and the familiar use of language is often very important to that end. Thus, mention of exclusively peaceful uses of outer space produces a favorable response whether or not an adequate definition of the word "peaceful" has been given and the reference to exclusiveness carries with it the corollary reference to prevention of non-peaceful uses. In the absence of adequate definition and reference to restraints, the emphasis, if not the wording, has shifted from a traditional concern for peace to the new emphasis upon the progressive development of space technology. The traditional dichotomy has broken down because recognizable activities of each are remarkably fused, because of the increasing recognition of military policing actions as contributions to peace on a large scale and because activities once regarded as peaceful have now been incorporated into a new and broader definition of warfare.

Heretofore it has often been possible to treat research and discovery as a purely peaceful scientific endeavor. Even development stages were considered innocuous even though the ultimate use of the development would not be. Whereas, at one time control of production of armaments and aircraft was thought adequate to prevent their mobilization for military use, we are now witnessing efforts to control the development of nuclear bombs because the link between development and use is so well forged. If this link were just due to the willingness of nations to enter upon crash programs it would not be of much interest here; however, it is stronger than that. Some types of basic research cannot be done inexpensively or on a small scale. They require large investments and in comparison applications of the results may be very easy. We see this most dramatically with the exploration of outer space. Lloyd Berkner has described the satellite as "perhaps the most powerful scientific tool of the present day."[24] Iet the intercontinental ballistic missile can be regarded as but a modification of the launching part of this basic research too. The United States tried to preserve the

[24] *ibid.*

distinction between military and peaceful space technology in setting up the Vangard satellite program as a project quite separate from that for military missiles. All indications are that this was not a viable distinction. Nor are ICBM's the only military application of rockets and satellites; General Schriever of the United State Air Force has stated that "satellites for reconnaissance, communications purposes have direct military applications . . . the military should be permitted to carry out its own research and development . . . because it is important that the developer and user work together."[25]

In contrast, the development of atomic energy offers more opportunity to maintain the distinction between military and peaceful development and use. The bomb tests have little to do with the development of nuclear reactors or controlled thermonuclear reactions. And as yet there has been little demand to put nuclear explosions to peaceful uses. There are also a variety of ways to distinguish between military and peaceful uses of controlled nuclear energy. Space technology is in a more difficult position than nuclear energy in this regard. From the point of view of research developments, rather than of military uses, there arises a new problem for pure scientific research. The use of satellites for research depends upon the cooperation of those in control of rocket production and use. The staff of the Select Committee of the House of Representatives has recognized this when it urged that the United States government invite foreign scientists to work with it since few of them will be able to exploit their talents and insights otherwise.

Because of the close technical link between military and peaceful research, development and use of some scientific discoveries, the problems for government, of maintaining a distinction between the two, are very difficult indeed. Either all efforts to exploit outer space must be prevented or each progression, from research and development to use, must be carefully supervised. If this is not done, then, because of the essential anonymity of a rocket or satellite once it is launched, the danger exists that a satellite ostensibly for scientific research is also a reconnaissance satellite of the type the United States is now speedily developing. We have no obvious way of knowing this without a full inspection system. Nevertheless, as we have seen, the United Nations resolution and other proposals respecting government of outer space are presented in terms of peaceful uses of outer space, as if these might be handled independently and even exclusively of military uses.

Assuming that feasable governmental arrangements are devised to supervise all phases of space exploration and exploitation, the fact

[25] Hearings Before the Select Committee on Astronautics and Space Exploration, 85th Congress, Second Session, on H.R. 11881, p. 648.

that the line of exploration may find application in a great variety of fields suggests a further link between military and peaceful uses which is not present in all areas of science and technology. In the atomic energy field emphasis has been placed upon special bomb designs representing variations in terms of physical size, explosion size and production of radioactivity. By comparison, the field of astronautics is wide open except for the convincing argument that satellites are not good platforms for earth bombardment.

Nevertheless, in the United Nations debate the analogy between government of atomic energy, where the problems of governing peaceful development and bomb testing are separated, and that for outer space was made by a number of delegates. It remained for the Australian delegate to recognize the unhappy fact that recent and future satellite and rocket experiments can open up new military possibilities which greatly complicate problems of security and control.[26]

Even assuming this dichotomy can be maintained, this is not to say that military uses should be suppressed. The more complicated, varied and interdependent our society is, the more important police actions may become; and we cannot now be sure that "space-policing" for maintaining peace on earth as well as in outer space, would not have merit. Full exploitation of outer space, unlike use of the high seas, may require unusual degrees of cooperation and control or else no nation will gain. If it were true that the ability of the United States to retaliate with atomic bombs helped to maintain world peace during one period of history, then military uses of outer space may serve the same function in the future. Astronautics contributes to the evolution of a still more highly differentiated and integrated world society whereas some other scientific developments increase opportunities for self-sufficiency.

In cold war situations something closely akin to military advantages and solutions to disputes is gained if a country can, by gifts, cooperation, propaganda or otherwise, induce individual scientists and nations to adopt its standards and techniques and come to look to it for education and leadership. For this purpose it may not even be necessary to *use* military techniques but only to start developing them, in order that the same result might occur. We must expect the day when even a new discovery will, while as yet quite undeveloped, be sufficient to produce the same consequences as would the development and threatening use of military power. Because space technology promises to enlarge the speeds, times and spaces over which human beings can operate effectively, opportunities for such warlike use of peaceful developments also increases significantly.

[26] Debate, *op. cit.*, November 17, 1958.

IV

In the face of recent developments in astronautics it may be particularly desirable to have a well worked out set of operating rules governing the outer space activities of nations. Rockets and satellites may affect nations in a variety of ways ranging from doing physical damage, jamming communications, or invading heretofore private domains, supplying them with beneficial weather information and scientific data, or aiding in communications. This range of possible effects is quite unique even though some of the same international situations have already appeared in more limited contexts. Radio communications and jamming efforts have crossed national boundaries, as have propaganda balloons. Increased interest in the high seas has been exhibited by many nations, and different adjustments have been made, depending upon whether the relevant consideration was defense, customs control, fishing rights, mineral rights, or navigation. New opportunities for communications and efficient use of resources have been created by the standardization and systematization of weights and measures, postal and telegraph communications, weather and market information and health measures. These and many other instances of contacts between nations suggest that astronautics does not promise totally new situations so much as opportunities to magnify many analogous opportunities for cooperation, or friction, among nations.

It is reasonable to expect that the accumulation of law and governmental arrangements, developed to meet the sorts of situations just mentioned, offer a measure of predictability and could be applied to astronautical developments as the situation calls for them.[27] Astronautics, however, introduces novel features. In so far as workable solutions to analogous legal situations are available, they suggest a trend towards solutions which may not aid stability and predictability so much as they aid the progress of scientific and technological developments. Rockets and satellites are the tools which form the core of many future conflicts, but also afford possibilities of cooperation. Previously, resolution of the conflicts were worked out piecemeal over long periods of time. A multiplicity of such problems has now been bound together and to them have been added some for which there are no ready precedents. Examples of this are seen in the unique position that many accrue to polar, equatorial or other regions because of the earth's spin and landing problems and the ever-present possibility of discovering techniques which make the enforcement or

[27] Prominent among operating organizations which have been concerned with the use of technological advances or have been mentioned in this connection are: International Atomic Energy Agency, International Civil Aviation Organization, International Council of Scientific Unions, International Telecommuication Union, United Nations Educational, Scientific and Cultural Organization, World Health Organization and the World Meteorological Organization.

frustration of regulations much simpler or more difficult as the case may be. It has been pointed out that the projected X-15 rocket plane will operate in exactly the area which some experts on air law think to be a suitable boundary area between air space and outer space.[28] The number of overlaying patterns of government for parts of the seas which are linked to functional considerations will have their analogues in outer space, but these legal patterns will have to develop rapidly if they are to offer much predictabiltiy. Analogous scientific considerations are going to arise in astronautics and they do not invite a simple compromise as to where to draw boundary lines. The science and technology of astronautics suggest that we can expect the adjustment of law and government to scientific facts to be a matter of perpetual awkwardness, if the traditional view of permanent rules and regulations is maintained. It has been pointed out that because of this interrelationship, "more than any other department of the law, space law requires this sort of broad appreciation (of the magnitude of technical, political, legal, and military considerations involved in the problems raised by man's conquest of space) yet surprisingly few of the non-legal sources on space . . . are even mentioned in the legal literature."[29]

If we consider the governmental solutions to problems and opportunities offered in some of the areas of international contact mentioned above, we see that these solutions involve the creation of active worldwide organizations and not just the formulation and acceptance of rules of international law which seem to maximize predictability. The adjustment of government to scientific opportunities reduces the prospects for long-range predictability in the interest of making day-to-day activity more sensible and predictable. Astronautics seems to put a premium upon government operating through organizations. It is possible that international space agencies will develop which will determine, on the basis of current scientific developments, the extent of a nation's territorial space with respect to some activity or the extent of privacy and independent operation available to a nation.

Alternatively, it is conceivable that a system of international rules and effective sanctions could be instituted which would permit us to predict, for instance, that territorial space will extend fifty-three miles up and that any rocket or satellite developments which might effectively enlarge or contract this protective shell over any nations will be banned. The unlikelihood of such a system being accepted is not only based on the difficulties of enforcement but also on the emphasis placed by modern society upon positive exploration of outer space. In this spirit the Peruvian delegate to the United Nations emphasized that the significance of the problem of outer space

[28] Katzenbach, *op. cit.*, p. 221.
[29] Hogan, *op. cit.*, p. 80.

lay in the magnificent opportunity it offered to the peoples of the world to achieve not only scientific cooperation but also moral solidarity.[30] If worldwide organizations are a prerequisite for this exploitation of outer space then two consequences appear to follow. First, we can expect some de-emphasis on the kind of predictability promoted by formal rules of international law, and second, we can expect these organizations to blur the distinction between private, national and international organizations and activities. In so far as such organizations begin to take an active part in research, development, production, use, control and policing—which may well be the case as astronautics progresses—they will become involved in what were heretofore regarded as purely domestic activities. Astronautics is but the latest and, together with atomic sciences, in some ways the most dramatic illustration of how scientific advance often increases the interdependence of the scientific genius, academic institutions, industries, governmental departments and legislators. To these we may now have to add parallel clusters of interdependent groups in many nations and between nations. The fact that few nations have the industrial wealth to carry on space exploration singlehandedly makes it probable that many nations may be able to contribute to some aspect of the development or will in any case be affected by this development.

Recognition of this trend towards increased interdependence and coordination in the interest of scientific advance is reflected in a number of the proposals for government of outer space. The emphasis in the United Nations resolution is upon finding effective means for international cooperation for scientific advance. Although the resolution portrays an interest in the legal aspects of government for outer space, this seems to receive less priority. By the terms of the resolution, the Ad Hoc Committee is supposed to report on "the nature of legal problems which may arise in the carrying out of programs to explore outer space"; it is not asked to consider the general legal framework which might dictate that all programs for exploration of outer space are illegal. The presumption is that beneficial programs can and should be furthered as quickly as possible.

Similarly, the staff report of the Select Committee on Astronautics and Space of the House of Representatives places priority upon study of the government of outer space in terms of international cooperation and has found that the study of "legal problems bound to evolve as the space age advances" is less pressing.[31] The recommendation in this report goes further than the United Nations resolution in that it recognizes the role of individual scientists in this cooperative enterprise without regard to nationality.[32]

The transnational character of the emphasis upon scientific

[30] Debate, *op. cit.*, November 13, 1958.
[31] *Op. cit.*, p. 2.

progress is clearly reflected in the governmental structure behind the International Geophysical Year. This pattern is specifically mentioned in the above resolution and seems to have been accepted as the archetype for future government of outer space. This conclusion has been drawn even though the space probes included in the IGY program constitute only a small fraction of the total IGY activities and, in fact, seem to have required much less international cooperation than, say, the collection of World Day data about meteorological and terrestrial phenomena. Indeed, it may be that the advantages in cooperation with respect to the latter efforts have promoted the satellite-launching nations to volunteer as much information as they have about their space explorations.

The operation of the International Geophysical Year illustrates that the goal of scientific achievement is beginning to take precedence over emphasis on security or predictability. In the traditional categories of thought the IGY might be regarded as a strictly peaceful activity. The distinction in thought between military and peaceful uses also led to a sense of surprise when it was realized that the launching of Sputnik I was not merely an achievement in peaceful scientific development. Similarly, the use of satellites in order to determine the size and shape of the earth with more exactness can be presented as an advance for geodesy, but it can also be recognized as an essential bit of knowledge for the accurate guidance of ICBM's. In other ways the information collected during the IGY will contribute to peaceful *and* military uses. This fact may have been in the minds of some sponsors of the IGY, but the most interesting characteristic of this worldwide program seems to have been the primary emphasis upon scientific advance without equal concern for its significance in the context of security.

The IGY emphasis upon achieving scientific advance also dominated considerations of legal precedent and relations among nations. The government of IGY represents an unusual amalgamation of individuals, private groups and both national and international authorities. If the future government of outer space is developed along these lines, it is not at all impossible that many of the present operations of national governments can be carried out with greater security and predictability than before even though these considerations may appear to give way to an overriding concern for scientific progress. As this process takes place there is, however, a danger that existing national and international governments, private companies, lawyers and other professional groups will be so wedded to existing institutional frameworks that they will be unable to make a full contribution to the exploitation of outer space. Astronautics has started within an old framework of thought but shows every sign of outgrowing it.

[32] *ibid.*, p. 14.

BOOK REVIEWS

Contributors to the Book Review section are members of the editorial staff of the JOURNAL OF INTERNATIONAL AFFAIRS and graduate students of the School of International Affairs. The books reviewed are selected on the basis of their general interest and importance to the study of international affairs.

SMOLENSK UNDER SOVIET RULE. By Merle Fainsod. (Cambridge: Harvard University Press), 484 pp. $8.50.

This study of regional party affairs for the period 1917-1938 is based on documents which were captured in Smolensk in 1941 by the *Wehrmacht* and which later fell into American hands. The fortunate accident that such documents are available to the West is complemented by the most fortunate choice of Professor Fainsod to examine them. The result of his research of the Smolensk Archives is an exercise in scholarship which is a model not only for the specialized area of Soviet studies but for the entire discipline of political science as well.

Most previous studies on Soviet local administration have been based on Soviet sources and interviews with refugees—both methods not as reliable as primary sources. Future Western studies based on such sources will look to the present work both as a signpost and as a warning. It is a signpost guiding researchers along routes that need to be travelled. It is a warning that the distinction must continually be made between Soviet myth and reality.

In spite of the mass of data of technical and specialized value, Professor Fainsod's book remains one of general interest. The fate of Rumyantsev, the local party secretary, even excites some sympathy—of which he is certainly not deserving. Still, when Kaganovich comes to Smolensk to purge Rumyantsev he comes as the "villain." And one wonders if the party purgers have not always come as villains in the eyes of the people of the Soviet Union.

Rigged elections, censorship, "academic freedom," arson as a protest against collectivization—all sustain the judgment that the Communist party is "essentially an army of occupation in an overwhelmingly peasant country."

Walter Darnell Jacobs

WORLD AFFAIRS: PROBLEMS AND PROSPECTS. By Elton Atwater, William Butz, Kent Forster and Neal Riemer. (New York, Appleton-Century-Crofts, Inc.), 621 pp. $6.95.

This is one of the finest basic texts to have been produced in the field of international politics in recent memory. Charged with the task of increasing international understanding among students of diverse interests, the authors have made a novel approach to the study of world affairs.

Ignoring the conventional, multi-discriplinary techniques, they have concerned themselves with what they believe to be the important problems of the time. The "problems approach," as they so aptly call it, is utilized in order to make the prime elements shaping the destiny of mankind more intelligible to the large body of the uninitiated.

Fourteen such problems are treated in this publication and they break down into four principal catagories: "The Individual and the Contemporary Crisis," "Factual and Fictional Sources of Tension," "Ideological Conflict and Accommodation," and "Techniques of Adjustment in World Affairs."

Lawrence Ziring

THE PATTERN OF LAND TENURE REFORM IN EAST ASIA AFTER WORLD WAR TWO. By Sidney Klein. (New York: Bookman Associates.) 260 pp. $10.00.

In this brief, compact book on the problems, strategy, and success of land tenure reform in East Asia, Mr. Klein, assistant professor of economics at Rutger's, has scored a brilliant success. With extensive use of bibliography, charts, and with penetrating analysis, Mr. Klein is able to present a clear and supportable view of this question in five East Asian countries after World War II.

The countries selected for study (China, Japan, North and South Korea, and Taiwan) had similar conditions and needs, with much the same to be accomplished in a short period of time. Though these factors limited comparison with the West, they offered an unlimited basis for comprehension of the various difficulties faced by many people of the world, not only those in East Asia. Essentially the conditions were: small areas of cultivable land in relation to population, ownership in the hands of a few, high levels of tenancy, taxes, rents, insecurity, and the resultant submissive attitude of farmers after years under such conditions.

In Japan, Taiwan, and South Korea, the land reform programs aimed simply at a redistribution of available land so as to increase ownership, and to reduce and improve conditions of tenancy. The exact needs of each country, the planning and formulation of legislation, the implimentation of such legislation and its success form the core of Mr. Klein's study of land reform in East Asia. Related problems such as long landlord domination and power, fear, dependency, ignorance on the part of a vast number of peasants, corruption and bureaucracy (or lack of it) which often hindered effectiveness, are intelligently dealt with.

In China and North Korea, however, Mr. Klein points out many shortcomings of the land reform done mainly to solidify the Communist Party gains, with economic betterment a definite second. In these chapters, Mr. Klein is remarkably objective, dealing only with the economic consequences of the Communist drive to collective farming, along with high taxes, required labor, party favoritism, propaganda, and armaments playing large roles. The end result is a comparative study of excellent and valuable merit.

Ernest Kalibala, Jr.

THE DIPLOMACY OF INDIA: INDIAN FOREIGN POLICY IN THE UNITED NATONS. By Ross N. Berkes and Mohinder S. Bedi. (Stanford: Stanford University Press), 221 pp. $5.00.

In an attempt to explain what has often been a puzzle to Western observers, Messrs. Berkes and Bedi have presented a sympathetic, though extremely fair, analysis of Indian policy in the United Nations. Through the tracing of India's participation in a wide range of issues involving the Great Power conflict, the authors have evolved the theory, which is thoroughly justified by the evidence, that India's policy has been motivated by what they term the "climate of war." India's objective under this theory is to create an atmosphere for negotiated settlement of Great Power disputes with minimum emphasis on the substantive issues involved. Although the authors believe that the avoidance of condemnatory resolutions and inflexible negotiating positions, which the climate of war theory attempts to avoid, would have benefited the West at certain times, they also show that the theory has not been consistently applied.

It is pointed out that the moral lessons taught by India to the West have many times been forgotten when India was advancing its self interest, or when communist violations of human rights were involved. On the other hand, when India presses matters concerning the social, political, and economic problems of Afro-Asia, it is the United States which stresses the importance of maintaining a climate for negotiation.

The official reports of the General Assembly and the Security Council have been used almost exclusively as the source material for this book. Reliance on this source may no longer be valid considering the recent trend in United Nations diplomacy which has placed emphasis on negotiations outside the General Assembly with formal approval

solicited within the Assembly only after substantial agreement has been reached. Future studies of United Nations diplomacy will have to rely heavily on the memoirs and diaries of the participating statesmen.

This book gives a comprehensive picture of India's contributions to Great Power harmony and its militant advocacy of Afro-Asia rights. The conclusions that the authors have drawn from their detailed presentation of facts are generally sound and deserve careful consideration in the light of the increased voting strength of the Afro-Asian countries.

Michael Bradfield

These volumes are part of a series of National Studies on International Organization initiated by the Carnegie Endowment for International Peace and carried out by private organizations and individuals in more than twenty countries. In sponsoring this project the Endowment has sought to encourage an exchange of unofficial national views, with the object of stimulating a closer examination of the past record and future potentialities of the United Nations and of increasing understanding of differences and similarities in national attitudes toward the UN.

JAPAN AND THE UNITED NATIONS. By Kisaburo Yokota and Tomoo Otaka. (New York: Manhattan Publishing Co.) 246 pp. $3.00.

This study was prepared by Professors Yokota and Otaka under the auspices of the Japanese Association of International Law. It examines (1) The development of Japan's attitude towards the United Nations since its surrender; (2) The evaluation of the structure and activities of the Organization; and (3) The United Nations' role in dealing with Far Eastern problems with special reference to Japan's security and its admission to the United Nations.

The authors have done a splendid job in summarizing the complex and diverse feelings which prevailed in postwar Japan and the evolution of governmental policies resulting from the changes in the world situation. I believe the major contribution of this study would be the scholarly opinions on international organization, especially from Japan's point of view, expressed in Part Two of the book.

Special emphasis is placed on the security aspect and maintenance of peace. This position is understandable, however, considering that Japan is the only nation in the world to have experienced the destructive force of the A-Bomb, and, in its new constitution, has renounced armaments and the right of war. From my experience and knowledge, having resided in Japan from 1946 to 1955, I can safely recommend this accurate and authoritative work, especially to those who have a particular interest in Japan.

Frank T. Yorichika

CANADA AND THE UNITED NATIONS. By F. H. Soward and Edgar McInnis with the assistance of Walter O'Hearn. (New York: Manhattan Publishing Company), 285 pp. $3.00.

This volume is one of the better books in the series and is a major contribution to the scholarly study of the international relations of Canada and that nation's role in the formation of the United Nations and its development.

The first three chapters deal with the military aspects of Canada's international relations. They trace briefly the history of Canadian foreign relations from its isolationist position in the League of Nations down to its present-day world wide interest in maintaining the peace of the world.

In addition, the book deals with the major role played by Canada in the development of the economic and social aspects of the United Nations. Canada's position toward aid to the underdeveloped countries is considered along with her role in the various Specialized Agencies. The last two chapters deal mainly with the structure

and functioning of the United Nations and Canada's positions toward the problems of Charter review and revision.

This book is recommended both for the serious student and for the casual reader. The style of writing lends itself to very informative, rapid and enjoyable reading. A much better understanding of the reasons behind Canadian actions in the United Nations will be gained by its reader.

Melvin Morris

LA SUISSE ET LES NATIONS UNIES. By Jacqueline Belin. (New York: Manhattan Publishing Company), 139 pp. $3.00.

Switzerland's traditional neutrality has been emphasized so often that one comes to think of it as an absolute and unvarying element in international politics. The present volume modifies this preconception.

It becomes clear that up to the battle of Marignano, Swiss Cantons were actively engaged in a network of alliances. Although they kept aloof from foreign entanglements only after 1515, their neutrality was not formally recognized until the Congress of Vienna.

Switzerland, being a miniature community of nations, has for a long time favored international cooperation. Always ready to foster legal, technical and economic (if not political) agencies, it redefined its position as "differential neutrality" to join the League. Although the Charter would make a similar accommodation with the U.N. difficult, many of its non-political branches enjoy Swiss support.

Madame Belin stresses the differences between legal and political aspects of neutrality. In the first sphere, Switzerland's situation has changed, for neither of the two current Great Powers explicitly recognizes its special standing. In the second, on the other hand, the full freedom always retained in balancing the political rights and responsibilities of neutrality leaves the door open for greater participation in world affairs.

The author's exposition of her subject is admirably clear and could, indeed, be held up as an example to political scientists.

Fabrizio Melano

URUGUAY AND THE UNITED NATIONS. (New York: Manhattan Publishing Company), 129 pp. $3.00.

This book is divided into three main chapters. The first deals with the historical background of Uruguay's experience in international organization. The League of Nations and the Inter-American Union are discussed in reference to how they influenced the Uruguayan viewpoint toward the formation of a new international organization after World War II.

The second chapter deals principally with the founding of the United Nations and the views of the delegates of Uruguay on the various Charter provisions. The best sections of this chapter deal with Uruguay's attempts to strengthen the position of the middle and small power states. Although the results were often disappointing, Uruguay wholeheartedly supported the final draft of the Charter. She did this for a variety of reasons, the strongest of which was the belief that the Charter would soon have to be revised and that then, in light of experience, the Uruguayan views and proposals would prevail.

The conclusion deals with what has been the actual position of Uruguay on various problems that have confronted the United Nations. Such problems as the questions of domestic jurisdiction and voting in the Security Council are discussed as well as the problem of membership, regionalism, and economic cooperation. The conclusions are extremely interesting since they are approved by several former Presidents and Foreign Ministers of Uruguay and thus give them the weight of official approval.

Melvin Morris

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